# SUMMARY REPORT

# JOHN DAY FALL CHINOOK/SALMON MITIGATION PLAN
# ACCLIMATION AND IMPRINTING
# SITE FEASIBILITY STUDY

Completion Report

**by**


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TABLE OF CONTENTS

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## APPENDICES

# I INTRODUCTION

Pursuant to the Pacific Northwest Electric Power Planning and Conservation Act and adoption of the Northwest Power Planning Council's Fish and Wildlife Program, federal, state and local agencies, the Columbia River Inter-Tribal Fish Commission, public and private utility companies and others are working to preserve, and where necessary, enhance naturally spawning stocks of salmon and steelhead in the Columbia River drainage. A portion of this effort is referred to as the John Day Fall Chinook Salmon Mitigation Plan. The purpose of this Plan is to replace upriver bright fall chinook salmon which were lost by construction of the John Day Dam. This will be accomplished by releasing salmon fry and smolts, incubated in the Spring Creek and Bonneville Hatcheries. at several upriver locations. Prior to release it is desired to feed and acclimate the juvenile fish to relieve the stress of truck transport, and to imprint them to the release site. This will ultimately produce adult chinook salmon that return to their historic spawning areas through traditional common property fisheries. It will also provide sexually mature broodstock fish that can be captured and spawned to supplement continued hatchery operation.

Goals for the proposed acclimation facilities have been established jointly by the Columbia Basin Fish and Wildlife Council and the Columbia River Inter-Tribal Fish Commission with participation by the U.S. Fish and Wildlife Service (USF&WS), the Oregon Department of Fish and Wildlife (ODF&W), the Washington Department of Fisheries (WDF) and others. Funding is provided by the Bonneville Power Administration.

This report summarizes results of an engineering feasibility study done for 10 potential acclimation sites on the Columbia, Yakima and Walla Walla Rivers. A detailed report has been prepared for each site and each is bound separately.

This feasibility study was prepared by Sverdrup Corporation, engineering consultants in Bellevue, Washington through a contract with the USF&WS. Management has been by the USF&WS.

The 10 sites are:

- Sunnyside Dam, Yakima River, Washington
- Union Gap, Yakima River, Washington
- Prosser Juvenile Trap, Yakima River, Washington
- Granger Side Channel, Yakima River, Washington
- Hat Rock Park, Columbia River, Oregon
- Willow Creek, Columbia River, Oregon
- Tidewater Barge, Columbia River, Oregon
- White Bluffs, Columbia River, Washington
- Ringold Springs, Columbia River, Washington
- Walla Walla, Walla Walla River, Washington

Union Gap, Granger Side Channel and Tidewater Barge have been eliminated from consideration for reasons discussed in Section XI. Also, as an alternative to the Willow Creek site, 3 Mile Canyon has been added to the project. Figure 1 is a project location map and Figures 2 through 9 are vicinity maps for each site.

# II PRODUCTION GOALS

Ultimately the goal is to acclimate 11,500,000 fry (subyearlings) initially at 100 fish per pound and 225,000 smolt (yearlings) initially at 20 per pound. This production would be spread among sites determined to be suitable for construction of acclimation and imprinting facilities.

The acclimation facilities will be somewhat experimental and different fish sizes, times of release and acclimation periods will be used to evaluate project effectiveness. Each facility is planned so that at least three individual lots of fish could be held at one time. For estimating volume and flow requirements, four acclimation periods of 0, 7, 14 and 21 days were used.

Based on ODF&W requests, the Oregon sites were evaluated to determine their ability to provide acclimating and imprinting for 30,000 pounds of fry or smolts in four 7,500 pound lots. So that equal comparisons could be made, the Washington sites that required pumping were also planned for 30,000 pounds of fish. The number of fish that could be raised at other Washington sites was limited only to the amount of water available.

# III BIOLOGICAL CRITERIA

Volume and flow requirements for salmon fry and smolt cultured in ponds are dependent upon fish size and water temperature. These are usually expressed in terms of pounds of fish per cubic foot of water (lbs/pcf) per inch of body length for volume and pounds of fish per gallon per minute (lbs/gpm) per inch of body length for flow. Values for each parameter vary, depending on water temperature. For example, values for chinook salmon fry at 90 per pound (3.3 inch body length) and 55 degree Fahrenheit (F) water are 1.5 lbs/pcf and 4.9 lbs/gpm. Table 1 is a list of the flow and volume criteria used for salmon culture in controlled enclosures. There are other critical parameters which primarily have to do with water quality but, provided dissolved oxygen is sufficient, for engineering studies they are less significant.

- TABLE 1 -

Flow (lbs/gpm) and Volume (pcf) Criteria
for Fall Chinook Salmon

| Temp. Degrees F | Fish Size (no/lb) 90 | | 40 | | 20 | | 15 | | 7 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | lb/gpm | pcf | lb/gpm | pcf | lb/gpm | pcf | lb/gpm | pcf | lb/gpm | pcf |
| 50 | 7.3 | 1.5 | 8.6 | 1.5 | 9.7 | 1.9 | 10.4 | 2.1 | 10.7 | 2.1 |
| 55 | 4.9 | 1.5 | 5.9 | 1.5 | 6.6 | 1.9 | 7.0 | 2.1 | 7.2 | 2.1 |
| 60 | 3.3 | 1.5 | 3.9 | 1.5 | 4.4 | 1.9 | 4.7 | 2.1 | 4.8 | 2.1 |
| 65 | 2.2 | 1.5 | 2.6 | 1.5 | 3.0 | 1.9 | 3.1 | 2.1 | 3.2 | 2.1 |

Fry and smolt in floating net pens, natural ponds or other similar enclosures that do not have controlled flow patterns and/or high water exchange rates must have lower stocking densities or stress, disease and high mortalities will occur. In these situations, densities on the order of 0.2 pcf are more appropriate.

Fish culture standards and engineering criteria used for this work are from <u>Fish Hatchery Management</u> by the USF&WS and from other accepted authorities. A bibliography is in Appendix C.

## IV SITE CRITERIA

For this feasibility study, land based and floating facilities for fish rearing were considered. Also considered was less intensive fish rearing in natural ponds or streams. Each have their own particular biological and site requirements. The site selection criteria follows:

### A. Land Based Sites

Criteria for a land based acclimation facility includes a reasonably level site; suitable access; at elevations above flood level but still low to reduce pumping costs, if required; close to adequate water sources; the availability of strong foundation materials; and the ability to attract, capture, and hold returning adult fish. Secondary considerations include the proximity of utility service, land ownership, interference with existing land uses, cultural resources and a location suitable for fisheries terminal harvest.

### B. Water Based Sites

Floating fish rearing enclosures considered for this project include net pens that rely on river currents for water supply and raceways that have a pumped water supply. The primary criteria for net pens is, therefore, that the site have continuous currents. Quantified maximum or minimum velocities are not suggested in this report. Rather, an acceptable range for each location was based on observations and fisheries engineering judgement. Floating raceways are used when the site does not have a minimum current. Other criteria, common to both enclosures, include protection from wind and waves, water depths greater than 30 feet or so, bottom materials suitable for holding anchors, an adjacent shore side site for support facilities and tanker truck access, enclosures within roughly 400 feet of tanker truck parking for fry transfer and, if possible, a unique water source for imprinting.

# V ALTERNATIVE REARING ENCLOSURES

Several types of enclosures for salmon fry and smolt rearing were considered in this feasibility study. Alternatives are necessary so that multiple comparisons can be made at a particular site and so that various options at various sites can be compared. Each rearing enclosure considered has its own good and bad features. One may have a longer life and fish culturists feel it is more manageable. But it could be considerably more expensive than a hard-to-manage and less durable enclosure. A menu of choices makes this feasibility study more complete and more apt to assist decision-makers with their final selections. The rearing enclosures considered are described in detail below.

## A. Concrete Raceways

This enclosure, built from cast-in-place reinforced concrete, is modeled after the "standard" used throughout Washington, Oregon, British Columbia and Alaska. Each raceway is 10 feet wide and 100 feet long. with an average 3.5 foot water depth and 1 foot of freeboard. They are side-by-side so that adjacent raceways have a common wall.

Water will enter the upstream raceway end via a valved manifold with nozzles. It will leave by flowing over an adjustable stop log weir into a rectangular concrete channel. Screens at both upstream and downstream ends will contain the fish. The lower end of the raceway will also have a kettle, mud valve and separate pipeline to transfer fry and empty the raceway. A walkway grate will be provided at both ends and on every other common wall to allow access for fish culture operations. The drain channel will lead to a fish ladder. Returning adults can enter the channel, a sorting area and then raceways for holding prior to being spawned.

Eight raceways providing enough volume for 30,000 pounds of fish are proposed at the Oregon sites and the pumped Washington sites. The Washington sites with larger quantities of gravity flow water would have 10 raceways plus asphalt lined ponds. Conceptual level design details are shown in Figure 10.

B. Asphalt Lined Ponds

The various sites have different fish capacities and management possibilities. Therefore, two sizes of asphalt lined ponds are proposed. The larger one is the standard WDF 1/2 acre pond. It is roughly 100 by 200 feet at the top, trapezoidal in cross section with 83,000 cubic feet of water volume. The smaller pond is quite similar. It is 40 by 80 feet at the top and has 7,800 cubic feet of water volume. Both ponds have sloping sides and a valved inlet pipe manifold with numerous nozzles to assure uniform flow distribution. Flow leaves through a screened vertical pipe with provisions for variable pond level adjustment and complete emptying of the pond. The screened intake area is large enough to prevent excessive velocity during normal operation. It is also accessible for adjusting and cleaning from a catwalk above. The larger ponds have a 12 to 1 ramp to allow equipment access for cleaning. Conceptual level design details for two configurations of the small asphalt lined ponds are shown in Figures 11 and 12.

Impermeable fabric lined ponds, which are essentially identical, have also been considered in cost estimates. However, because of the similarities, drawings have not been included.

Four small ponds are required for the sites with 30,000 pound capacity. Each 1/2 acre pond will hold approximately 50,000 pounds, and up to four are proposed for sites with large water flow volumes.

C. Vinyl Raceways

Vinyl is not necessarily the fabric used in current "vinyl" raceways. It could be hypalon, PVC, or other similar materials. This is a designation that has been used for years and its use here is for purposes of reader familiarity.

Vinyl raceways, typically 8 by 80 by 2.5 feet deep, are a low cost alternative to reinforced concrete. They usually have a steel frame with plywood or steel walls and floor that support a fabric liner. Sometimes they are partially buried. Water enters the upstream end through a valved manifold and exits through a screened standpipe. Most often groups of vinyl raceways are positioned with 4 feet or so of clearance between them to allow access to both sides for fish culture operation. Conceptual level design details are shown in Figure 13.

At the Oregon and pumped Washington sites, 18 vinyl raceways that can hold 30,000 pounds of fish are proposed as an alternative to concrete raceways or asphalt ponds. At Ringold Springs, where one option is to expand the existing WDF rearing facility, 15 vinyl raceways are proposed.

D. Floating Net Pens

This rearing enclosure is modeled after net pens that have recently been developed for fish farming in the Pacific Northwest, Norway and Japan. They basically consist of floats that support a frame that holds a net. In some designs the floats also support a walkway around the net enclosure for pedestrians and even vehicles to make work easier. When the net pens do not have walkways, fish feeding and maintenance are conducted from a boat.

For these facilities, juvenile fish would be loaded into the pens with a long hose or flexible pipe from a tank truck on shore. Release into the river is accomplished by dropping half the net and then lifting the other half from the water. River currents bring oxygen to the salmon fry and the same currents remove metabolic wastes. The heavier unused food and fecal matter fall to the bottom. Typically, several nets are clustered together and held in place by an anchoring system.

There are several commercial manufacturers of floating net pens that could be suitable for use on this project. It would also be possible to design and construct net pens using generic materials. Designs, volumes and prices from one representative commercial company were used for this study. For 30,000 pounds of chinook fry , six 12 meter by 12 meter by 5 meter net pens are required. This produces a loading density of 0.23 pcf, which is considered acceptable for this level of conceptual design.

E. Floating Raceways

This rearing enclosure is very similar to the net pen structure except the sides and a portion of the bottom are of impermeable fabric and the raceways have a pumped water supply. The impermeable fabric contains the pumped water so that it is available to the fish. The intent is to create a slowly rotating current with a net downward velocity. The fish receive oxygen from incoming water and metabolic wastes and unused food leave through the net in the bottom of the pond. A very small hydrostatic head differential between the inside and outside, as well as an anchoring system, helps maintain the pen shape.

The pens are supplied by water pumped from the river and a ground water well. After mixing, the river and ground water flow to the pens in a submerged pipeline held on the bottom with concrete anchors. The pipe has swivel connections on the bottom and on the pen floats to allow vertical and horizontal pen movement. Distribution to each individual pen is accomplished with pipes on the floats and manifolds similar to those used for the shore based enclosures.

## VI WATER SUPPLY

Of the seven viable acclimation sites, plus the Willow Creek alternative site at 3 Mile Canyon, only two have gravity water available. Therefore, six sites are required to have a pumped water supply. These sites were all evaluated for the same pounds of fish production and required flow rate so that each comparison would have an equal basis.

The 30,000 pounds of fish production planned for each of the pumped sites require 15 cubic feet per second (cfs) water flow. Since pumping costs are directly proportional to head (the total water lift in feet), it is usually much more economical to pump surface rather than ground water. However, since returning adult salmon home on the water source, their imprinting to a unique supply is required. River water alone would not allow adults to find their imprinting site. Therefore, it is proposed that pumped river water be supplemented with a small quantity of ground water. The Sunnyside Dam site is an exception to this. Only pumped river water will be used because the dam is a barrier to upstream migration and returning adults are required to use the existing fish ladder. With modifications to the ladder (discussed in the site report), adults can be captured and imprinting water would be unnecessary. (Chemical imprinting instead of using a unique water supply may be possible, but was not considered in this study.) A hydrogeotechnical study was conducted for each of the five pumped sites to obtain recommendations for well potential. These studies are in the

Appendix of each individual site report and they are summarized in Appendix B of this report. The findings were, generally, that low yield wells could be developed at depths from 150 to 1,000 feet. Low yield is on the order of 1 to 2 cfs. This study, therefore, is based on a mixing ratio of 13 to 14 cfs river water with 1 to 2 cfs well water. Although the well and river water pump station required at each site have some site specific characteristics (discussed in the site reports), they are similar in most regards. A description of each follows:

A. <u>River Water Pump Stations</u>

The river water pump stations are required to deliver 13 to 14 cfs, however, it is always desirable to size pumps and pipes with a slightly greater capacity. Also, instead of one large pump, it is preferred to have multiple smaller pumps. Therefore, these pump stations are proposed to have three pumps, each capable of supplying 6 cfs. One pump or all three simultaneously can be run, depending upon fish requirements at a particular time.

The pumps would be low head, vertical turbine type, each with a pump control valve, check valve and isolating gate valve. Each pump has a 14 inch diameter discharge which manifold together into a 24 inch supply pipe. The pump station structure is a reinforced concrete deck on pilings that extend out into the river. The distance into the river depends on the bottom slope at each site. The structure is designed to support a maintenance vehicle. The pump intakes have 1/8 inch mesh screen and the area is sufficiently large to keep through-screen velocities much below 0.5 feet per second. The pump motors are enclosed by a 12 foot chain link fence, and all electrical equipment is in weatherproof boxes. The discharge pipe is laid on the deck surface until it reaches shore, where it is buried. Conceptual level pump station design drawings are shown in Figure 14.

B. Ground Water Wells

One to two cfs in most cases can be produced by a 10 to 12 inch well. However, for the very deep wells, the first few hundred feet of casing probably will have to be larger. Each well would be equipped with a submersible well pump, a pump control and gate valve and necessary electrical equipment. The discharge pipe would be 8 to 10 inches in diameter and connect to the river pump station discharge pipe. Mixing valves would be provided for fine control on ground and river water flow rates. The valves and electrical equipment would be above grade on a fenced concrete slab.

C. Gravity Supply

Water flow by gravity is always the preferred choice for reasons of reliability and economy. However, sites with this attribute are hard to find and only 3 of the original 10 sites have potential for gravity flow. At Ringold Springs, 77.5 cfs (and possibly more) can be delivered in two existing and one proposed pipeline. At Prosser, 15 cfs gravity flow is planned, but there are complications in obtaining water rights. At White Bluffs, limited gravity flow from an irrigation runoff ditch is possible, but quality and temperature problems may make it unattractive.

# VII WATER QUALITY

There are water quality parameters with allowable ranges of concentration that are commonly accepted as being suitable for chinook salmon culture. Surface water, and where possible, ground water samples were collected for analysis to check these parameters at all sites being considered by this study.

Table 2 lists the parameter, its allowable concentration range, and the concentration found at each site.

## TABLE 2
# WATER QUALITY TEST RESULTS

| PARAMETER | ALLOWABLE RANGE | SUNNYSIDE | PROSSER | WHITE BLUFFS | | HAT ROCK | | RINGOLD | | WILLOW CREEK | THREE MILE CANYON | WALLA WALLA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | River | Wasteway | Pond | Well | Springs | Wasteway | | | Pond | River |
| Alkalinity ($CaCO_3$) | 100–400 mg/l | 37 | 50 | 59 | 237 | 221 | 289 | 228 | 169 | 90.0 | 69.5 | 254 | 180 |
| Ammonia (un-ionized) | <0.0125 mg/l | 0.051 | 0.054 | 0.095 | 0.023 | 0.035 | 0.028 | 0.018 | 0.059 | 0.062 | 0.080 | 0.077 | 0.059 |
| Chloride | <4.0 mg/l | 2.8 | <1.0 | 3.3 | 31. | 17.5 | 62.2 | 27. | 16. | <1. | 1.8 | 11. | 14.9 |
| Chlorine | <0.003 mg/l | N.P. | N.P. | N.P. | N.P. | N.P. | N.P. | N.P. | N.P. | N.P. | N.P. | N.P. | N.P. |
| Copper (in soft water) | <0.006 mg/l | 0.004 | 0.003 | 0.007 | 0.001 | 0.009 | 0.002 | 0.003 | 0.002 | 0.012 | 0.007 | 0.002 | 0.005 |
| Dissolved Oxygen | >7.0 mg/l | 12.0 | 12.8 | 12.3 | 7.35 | 18.8 | 9.6 | 15.1 | 9.9 | 13.8 | 13.2 | 11.4 | 14.5 |
| Nitrate ($NO_3$) | <1.0 mg/l | 0.715 | 0.429 | 0.496 | 0.689 | 4.33 | 2.43 | 4.298 | 2.391 | 0.283 | 0.380 | | 1.037 |
| Nitrite ($NO_2$) | <0.1 mg/l | 0.005 | 0.011 | 0.004 | 0.001 | 0.010 | <0.001 | <0.002 | 0.019 | 0.012 | 0.010 | 0.011 | 0.013 |
| Nitrogen ($N_2$) | <110% | <100% | <100% | <100% | <100% | <100% | <100% | <100% | <100% | <100% | <100% | <100% | <100% |
| Zinc | <0.005 | 0.013 | 0.065 | 0.060 | 0.048 | 0.044 | 0.124 | 0.033 | 0.042 | 0.267 | 0.120 | 0.028 | 0.029 |
| pH | 6.5–8.0 | 8.0 | 7.4 | 8.1 | 8.9 | 7.88 | 8.1 | 8.0 | 8.5 | 8.1 | 8.0 | 8.0 | 8.09 |
| Total Dissolved Solids | <400 mg/l | 143 | 220 | 132 | 482 | 440 | 611 | 506 | 371 | 168 | 145 | 398 | 380 |
| Total Settleable Solids | <80 mg/l | <0.1 | 0.7 | 0.1 | 0.1 | <0.1 | <0.1 | <0.1 | 0.1 | 0.1 | <0.1 | <0.1 | <0.1 |
| Total Suspended Solids | | 4 | 107 | 27 | 9 | | 2 | 3 | 32 | 27 | 34 | 12 | |

N.P. = Not Present

# VIII SUPPORT FACILITIES

In addition to the rearing enclosures, various support facilities are required at each acclimation site. These include housing and office space for the station manager; a freezer for fish food and an area for food thawing and preparation; a fish ladder and related structures for attracting, capturing and holding returning adult salmon; pumping stations for river water and ground water wells; various pipelines for water delivery and removal; and a security fence. This list of support improvements is not consistent or even appropriate at each site. However, it generally describes what is planned. The individual site reports discuss specifically which items are needed at a particular location. Brief descriptions of what is proposed follows:

## A. <u>Employee Housing/Office</u>

The acclimation facilities will only be used during May and possibly for 6 to 8 weeks in October and November each year. Therefore, only a temporary shelter is proposed for this use. The cost estimates for each site have an RV type mobile home for temporary housing and office space. This option includes a 5th wheel trailer with roughly 150 square feet of floor space parked on a concrete slab. The slab would be large enough for one vehicle with some outdoor furniture and limited storage. The waste system would be connected to a septic tank and drainfield. Water supply would be from the well. Electric power and telephone service would be provided by the local utility companies.

## B. Food Freezer/Preparation Building

For all acclimation facility sites it is assumed that frozen fish food for the entire rearing period will be brought in one shipment and stored on site. At 3.3 pounds of food per day per 100 pounds of fish, roughly 14,000 total pounds are required at the sites where 30,000 pounds of fish are reared. Table 3 shows the initial and final weights for each lot of fish and the food required. This table was developed assuming growth rates of 0.006 centimeters per degree Celsius temperature per day of feeding and constant 16 degree C water.

- TABLE 3 -

Food Requirements

| Lot No. | Acclimation Period (Days) | Weight of Fish (lbs) In | Weight of Fish (lbs) Out | Food Required (lbs) |
|---|---|---|---|---|
| 1 | 0 | 7,500 | 7,500 | 0 |
| 2 | 7 | 7,500 | 9,305 | 1,941 |
| 3 | 14 | 7,500 | 11,398 | 4,365 |
| 4 | 21 | 7,500 | 13,489 | 7,273 |
| | | | Total | 13,579 |

Two proposals for frozen fish food storage are presented in this study. One calls for a permanent masonry building that houses a walk-in commercial freezer and a thawing and food preparation room. The room would contain built-in counters, cabinets and sinks. The freezer would be similar to those manufactured by Balley. It would have a large sliding door suitable for fork lift access. All food would be stored on pallets on the floor except at Ringold, where the total amount of food needed is considerably greater. This freezer would have shelves for food in addition to that stored on the floor. The freezer and preparation building size at each acclimation site corresponds to the fish production at that site. For the 30,000 pound sites the freezer is 12 feet by 22 feet and the preparation room is roughly 10 feet by 22 feet. Also, each freezer building has a truck dock to facilitate loading. Conceptual drawings of the freezer building are shown in Figure 15.

The other food freezer concept is for a purchased or leased freezer van on wheels to be parked on site for the rearing period. It could be loaded at the food manufacturer's warehouse and towed to the acclimation facility. While in transit, the refrigeration equipment would run on propane or diesel fuel. On site the same equipment would be powered by electricity. A typical 40 foot van would have capacity in excess of that required for one month of feeding. The excess capacity could be used for a preparation room. An insulated bulkhead with pedestrian door could subdivide the van into 10 and 30 foot sections. The smaller section could be kept at ambient outdoor temperature and be used for thawing and preparation. The 30 foot section would be loaded through a sliding door on the side.

While on site, the van would be at a loading dock to make access in and out easier. Costs in Section IX are for the masonry freezer building described above.

C. <u>Adult Capture and Spawning</u>

Each acclimation site has provisions for attracting, capturing, holding and spawning the returning adult salmon. Sites with raceways, asphalt ponds or floating raceways each have similar facilities. The net pen sites, however, are different because there is no controlled source of attraction water.

The raceway spawning facilities consist of a Denil type fish ladder into the river. It is connected to a horizontal channel (where site conditions make it necessary) and then to a sorting pond where adults are separated by sex and degree of ripeness. From sorting, the adults are placed in the concrete raceway outlet channel so that they can swim into a raceway for holding. In October and November all raceways will be empty and fish culturists will have flexibility to hold multiple lots of adult fish. When actual spawning occurs, culturists can lower the raceway water level and crowd the fish to one end with a moveable barrier.

Spawning facilities for the asphalt ponds are similar. There is the same Denil fish ladder and horizontal channel which leads directly into one pond. Sorting and holding occur in the pond which is subdivided with fish fences for separating males and females. The spawning operation is similar to what is done in raceways. An asphalt-lined pond modified for adult holding or spawning is shown in Figure 16.

The typical water flow and volume criteria for holding adult chinook salmon are 8 cubic feet per fish and 2 gpm per fish. Therefore, each reinforced concrete raceway could hold 437 adults and the flow requirement would be about 2 cfs. The small asphalt ponds could hold 900 adults and would need over 4 cfs flow.

There are net pens considered for Hat Rock and Willow Creek. The adult capture, holding and spawning concepts for these sites are quite different from what is described previously. At Willow Creek the adult capture facility would be located next to the Interstate Highway bridge over the large backwater pond. At Hat Rock, it would be located behind the small dam. Neither site concept is the same. Because these are very site specific, they are described in detail in the site reports rather than this Summary Report.

Net pens were also considered at White Bluffs and floating raceways at 3 Mile Canyon. Both of these sites have shore based adult capture and spawning facilities that are very similar to what is proposed for asphalt ponds. These are also site specific and are more thoroughly discussed in the individual site reports.

In all cases, elaborate sorting or holding enclosures, fish crowders, spawning building, etc. have not been planned. This level of detail is not necessary, and valid site comparisons can be made without them.

## D. Pollution Abatement

Treatment of pond cleaning waste will probably be required at each site. However, it appears that a separate, specially built holding/aeration tank will not be necessary. Rather, as the ponds or raceways are vacuumed, the cleaning waste can be placed in an empty pond or raceway. Since fry will be released as early as zero or 7 days after arrival, there should always be space available.

Treatment can be through settling and evaporation. Residual solids can be removed by shoveling. Aeration could be added later if necessary.

## E. Standby Power

Thirty thousand pounds of chinook salmon fry represent a large capital investment which could be quickly lost by a power failure. Therefore, an emergency diesel generator is proposed for each site. The most appropriate type would be self contained with all controls, switch gear, fuel tanks, etc. in a module that can be removed from site when not in use. Roughly 100 kilowatt size would be needed at sites with shallow wells. Larger sizes would be needed for sites where a deep well is proposed. At locations that have gravity flow, a generator would probably be unnecessary. Specific details are outlined in the site reports.

F. <u>Security Fencing</u>

Salmon fry at these facilities are valuable and easily could be lost by vandalism. Also, since they are in generally remote locations unoccupied for nearly nine months each year, the permanent structures could be targets for abuse. Therefore, a security fence is proposed around all sites. It would consist of a 12 foot high chain link with a vehicle gate on the access road and other pedestrian and vehicle gates where appropriate. The fence proposed is shown on each facility site plan.

# IX COST COMPARISONS

Each of the individual site reports contain detailed construction cost summaries for various salmon fry rearing enclosures that are considered appropriate for that particular site. Table 4 summarizes these costs and it is organized so that a comparison between sites can be made. Table 5 shows the construction cost at each site per 1,000 pounds of fish released. The costs include a 15% contingency, but do not include land purchase, fees, engineering or other related expenses. They are based on construction being done in 1987, and to the extent possible, are site specific.

## TABLE 4

# COST COMPARISONS

| site | Concrete Raceways | Asphalt Ponds | Membrane Ponds | Vinyl Raceways | Floating Net Pens | Floating Raceways | Expand Existing | New at Existing | New at South Site | Oxbow Pond | Steelhead Pond | Removable Nets |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUNNYSIDE | 614,300 | 457,900 | 442,400 | 566,800 | | | | | | | | |
| | | | | | | | | | | | | |
| PROSSER | 439,500 | 308,700 | 293,100 | 392,000 | | | | | | | | |
| | | | | | | | | | | | | |
| WHITE BLUFFS | 902,800 | 784,900 | 769,400 | 855,300 | 327,100 | | | | | | | |
| | | | | | | | | | | | | |
| HAT ROCK | 771,600 | 649,300 | 633,800 | 724,200 | 247,800 | | | | | | | 138,000 |
| | | | | | | | | | | | | |
| RINGOLD | | | | | | | 1,239,900 | 1,883,200 | 1,158,000 | | | |
| | | | | | | | | | | | | |
| WILLOW CREEK | 1,107,700 | 995,200 | 979,700 | 1,060,200 | 516,200 | | | | | | | |
| | | | | | | | | | | | | |
| THREE MILE CANYON | 1,041,000 | 922,800 | 907,200 | 1,055,700 | | 932,800 | | | | | | |
| | | | | | | | | | | | | |
| WALLA WALLA | | | | | | | | | | 575,300 | 143,800 | |

## TABLE 5
# COST PER 1000 POUNDS OF FISH PRODUCED

| Site | Concrete Raceways | Asphalt Ponds | Membrane Ponds | Vinyl Raceways | Floating Net Pens | Floating Raceways | Expand Existing | New at Existing | New at South Site | Oxbow Pond | Steelhead Pond | Removable Nets |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUNNYSIDE | 14.73 | 10.98 | 10.61 | 13.60 | | | | | | | | |
| PROSSER | 10.54 | 7.40 | 7.03 | 9.40 | | | | | | | | |
| WHITE BLUFFS | 21.65 | 18.83 | 18.45 | 20.52 | 7.85 | | | | | | | |
| HAT ROCK | 18.51 | 15.57 | 15.20 | 17.37 | 5.94 | | | | | | | 3.31 |
| RINGOLD | | | | | | | 10.00 | 8.26 | 9.34 | | | |
| WILLOW CREEK | 26.57 | 23.87 | 23.50 | 25.43 | 12.38 | | | | | | | |
| THREE MILE CANYON | 24.97 | 22.13 | 21.76 | 25.32 | | 22.37 | | | | | | |
| WALLA WALLA | | | | | | | | | | 14.39 | 10.57 | |

# X COMPARATIVE EVALUATION

The Evaluation Matrix, Table 6, is a relative comparison of the acclimation sites studied. It lists the proposed improvements at each site and major evaluation criteria. The criteria has assigned ratings from O-5. Sites with higher total scores are favored over lower scoring sites. Many important criteria (such as terrain or soil types) are not listed because their influence is directly reflected by the construction cost estimates. Each criteria shown is assumed to have equal importance. However, this likely is not true when comparing, for instance, fish health to land availability. Therefore, reviewers are encouraged to reassign points based upon their opinion of the criteria's relative importance.

## TABLE 6
# EVALUATION MATRIX

| | SUNNYSIDE | PROSSER | WHITE BLUFFS Raceways/Ponds | WHITE BLUFFS Net Pens | HAT ROCK Raceway/Ponds | HAT ROCK Net Pens | RINGOLD Improve Exist. | RINGOLD Rebuld Exist. | RINGOLD New Site | WILLOW CREEK Pond/Raceways | WILLOW CREEK Net Pens | THREE MILE CANYON Raceways/Ponds | THREE MILE CANYON Net Pens | WALLA WALLA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fish Health | 1 | 1 | 1 | 1 | 4 | 4 | 5 | 5 | 5 | 1 | 1 | 1 | 1 | 0 |
| Adult Capture | 2 | 3 | 1 | 1 | 3 | 4 | 2 | 2 | 3 | 2 | 1 | 3 | 3 | 2 |
| Access | 3 | 2 | 2 | 2 | 3 | 4 | 5 | 5 | 4 | 1 | 0 | 4 | 4 | 4 |
| Land Availability | 0 | 0 | 5 | 5 | 4 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 |
| Water Quality | 4 | 4 | 3 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| Power Cost/Month | 3 | 5 | 2 | 4 | 2 | 4 | 4 | 4 | 4 | 0 | 4 | 0 | 4 | 1 |
| Average Construction Cost/1,000 lbs. Fry | 2 | 4 | 1 | 4 | 1 | 5 | 4 | 4 | 3 | 0 | 2 | 0 | 0 | 2 |
| Terminal Harvest Area | 5 | 5 | 2 | 1 | 4 | 3 | 0 | 0 | 0 | 5 | 5 | 5 | 5 | 5 |
| Total | 20 | 24 | 17 | 21 | 22 | 26 | 27 | 27 | 26 | 16 | 20 | 21 | 25 | 17 |

# XI SITES ELIMINATED FROM CONSIDERATION

The John Day Fall Chinook Salmon Mitigation Plan originally identified 10 sites to be studied. Three of these sites; Granger Side Channel, Tigewater Barge, and Union Gap Pond have been eliminated from consideration. Following is a brief introduction to each of these sites with reasons why it no longer is being considered.

## A. Granger Side Channel

This site is on an oxbow of the Yakima River at mile 82 on the right bank, approximately 1.75 miles northwest of downtown Granger, Washington. First indications were that this site was suitable for net Pen rearing. However, early studies identified three significant problems. During the spring acclimation period heavy Yakima River flooding would make net pen rearing infeasible. Also during low summer flows water temperatures in the oxbow are much higher than desired. Additionally the water could be polluted from flowing through areas used for intensive cattle rearing.

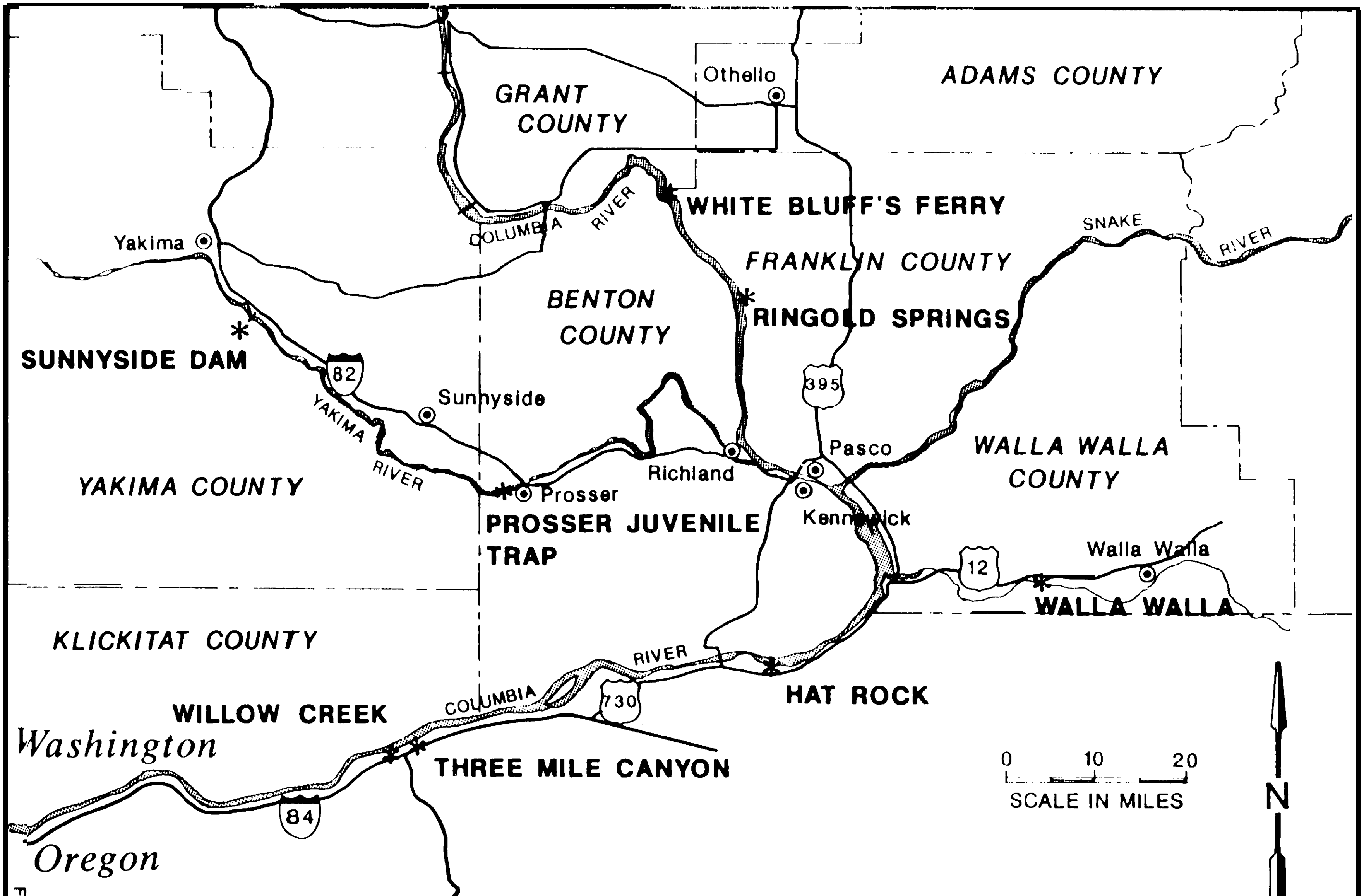
These problems were discussed with representatives of the Yakima Indian Nation (YIN) and the USF&WS and it was decided that they were of such magnitude that further work was unwarranted.

B. Tidewater Barge

This site is on the Columbia River, John Day Pool at mile 279 near the Irrigon Hatchery. It was felt this site would be suitable for raceway or pond rearing using ground water from shallow wells. However, from initial work it was learned that all ground water at this site would be used for steelhead, trout, and chinook salmon programs at the proposed Umatilla Hatchery. Therefore, to avoid duplication of effort, work at this site was suspended.

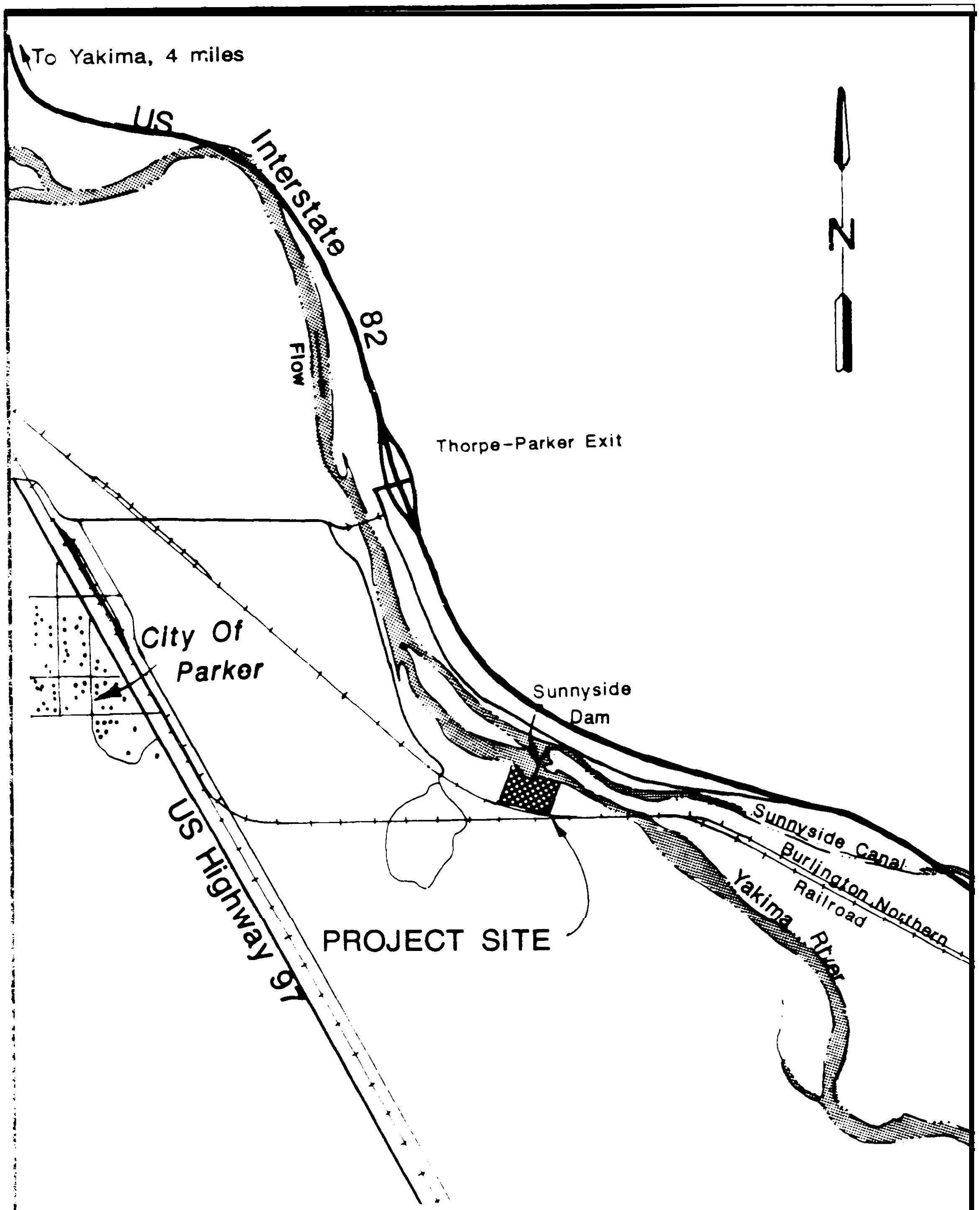
C. Union Gap Pond

This site is on the Yakima River left bank immediately below the Wapato Dam. The pond covers roughly 4-1/Z acres and it is 5 to 8 feet deep. Net pens were the initial fry rearing concept. Existing site access for vehicles is through a corrugated pipe under Interstate Highway 82. This pipe, however, is too small to allow passage of fry transport tank trucks. The Washington State Department of Transportation and Federal Highway Administration were contacted to determine if direct truck access from the Interstate were possible. The response was negative unless it could be shown that the Union Gap Pond site was overwhelmingly superior to other sites being considered. This response was discussed with the YIN and USF&WS and it was decided to discontinue further work at Union Gap.




## LOCATION MAP

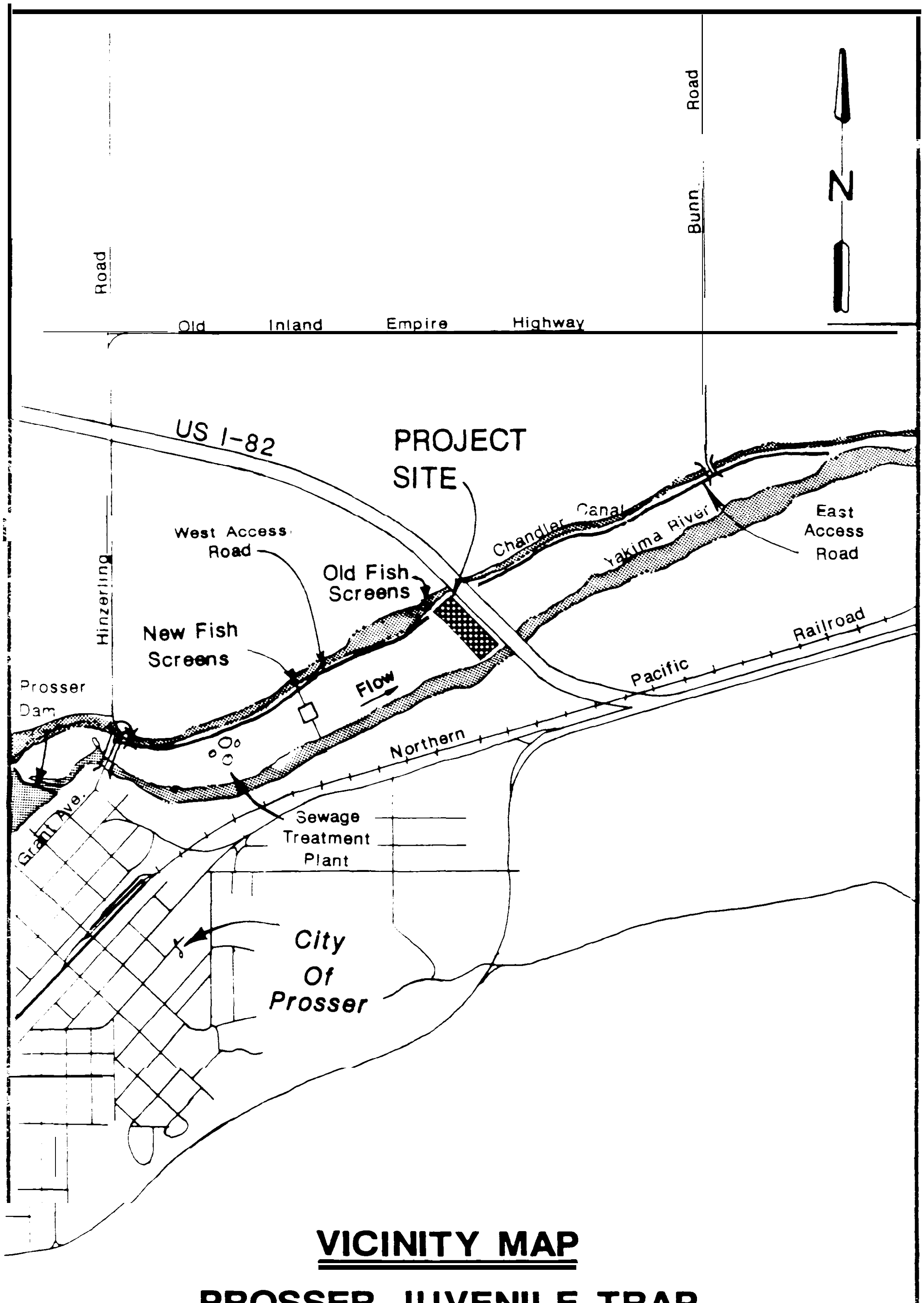
FIGURE 1




## VICINITY MAP
## SUNNYSIDE DAM

SCALE: 1"=2000'

FIGURE 2

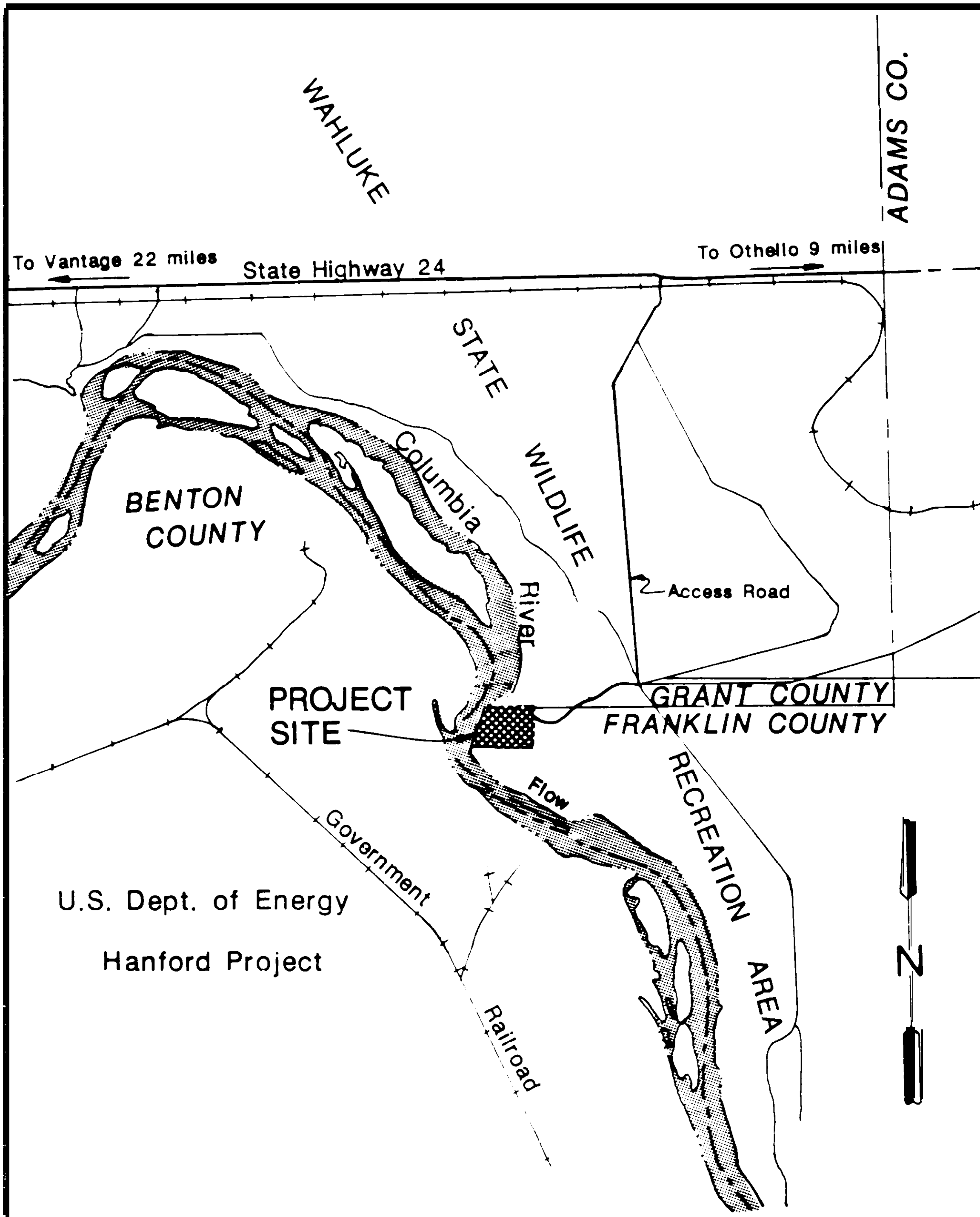



**VICINITY MAP**

**PROSSER JUVENILE TRAP**

SCALE: 1"=2000'

FIGURE 3

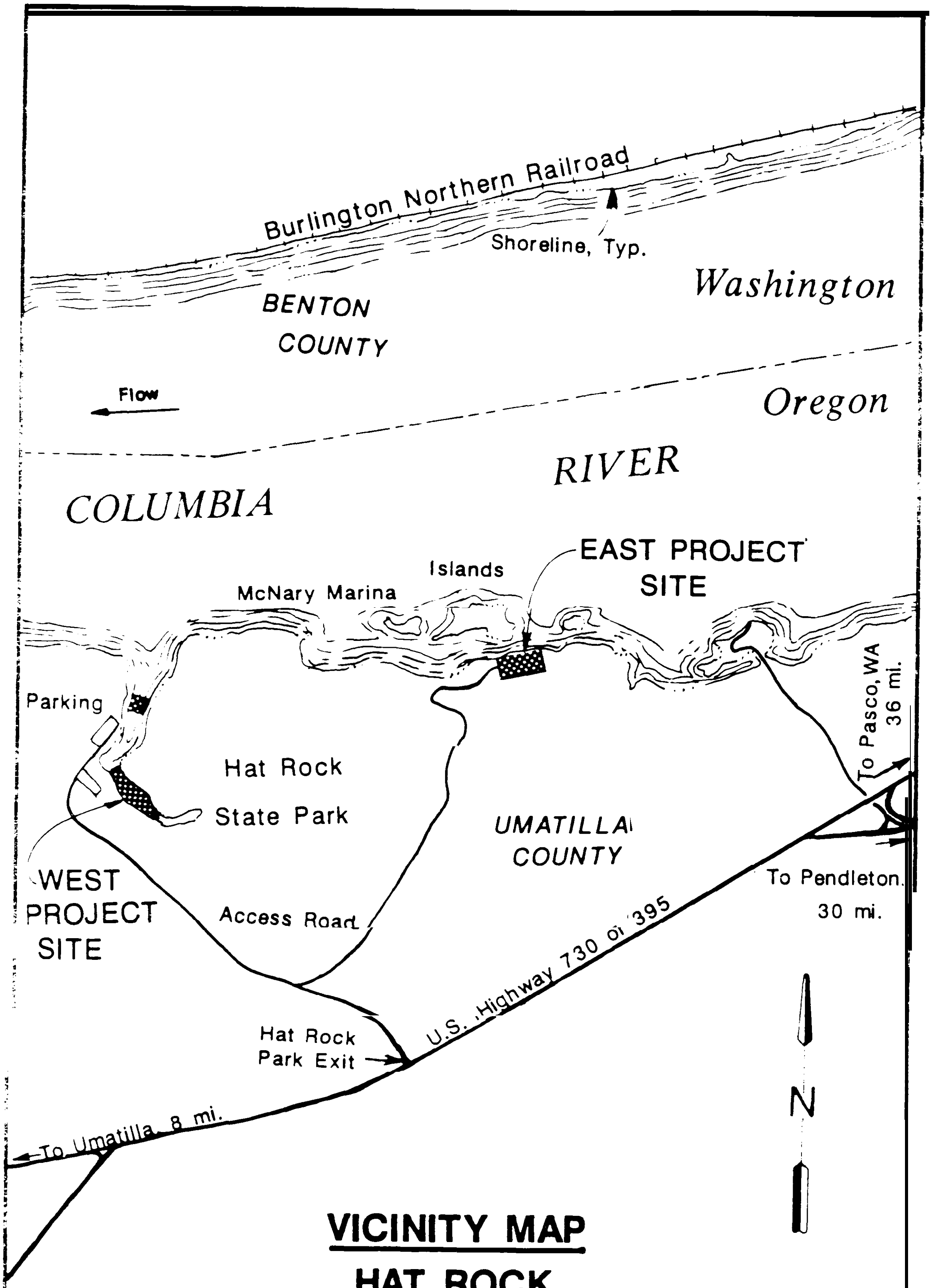



**VICINITY MAP**

**WHITE BLUFFS FERRY**

SCALE: 1"=2000'

FIGURE 4

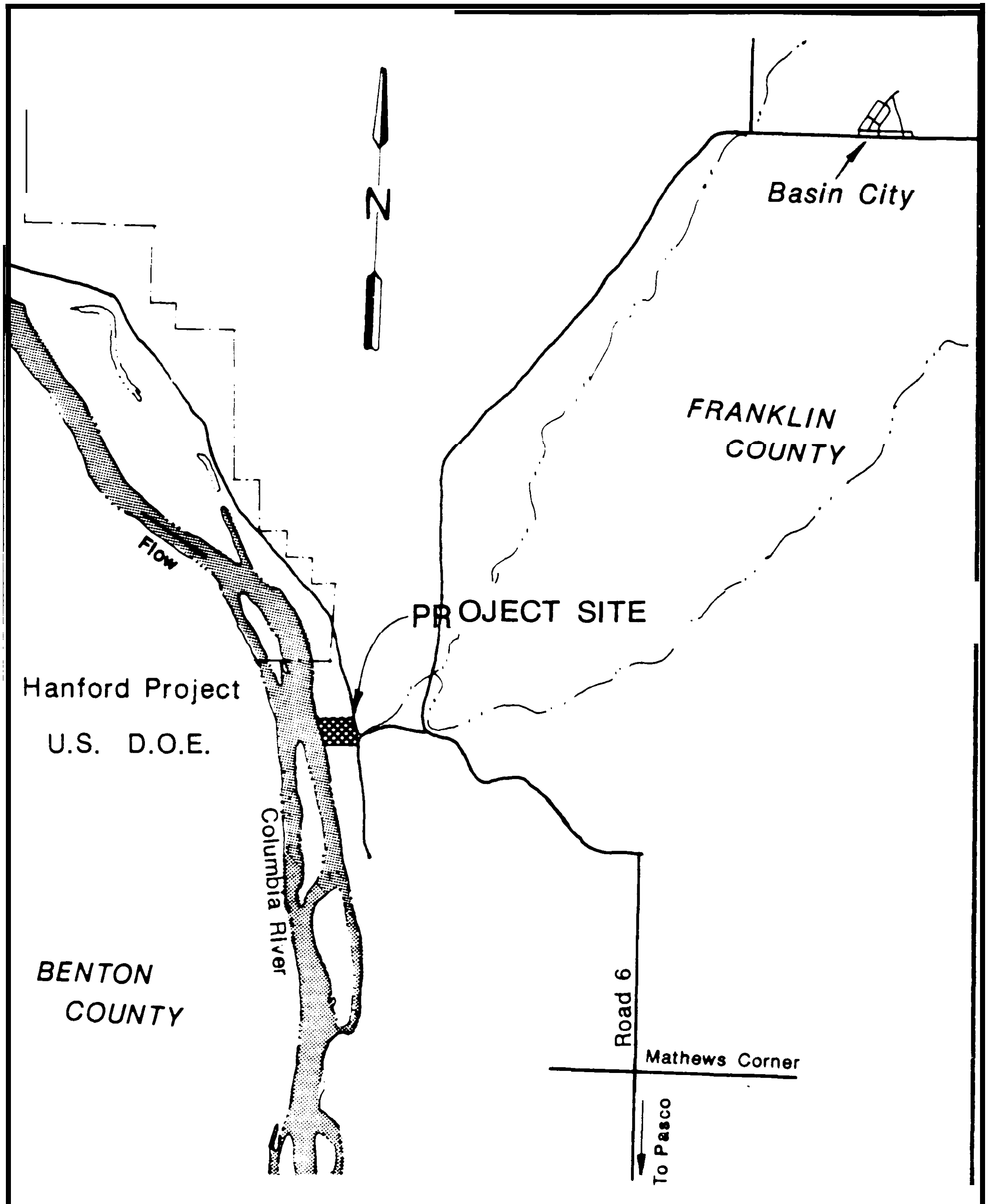



**VICINITY MAP**

**HAT ROCK**

SCALE: 1"=2000'

FIGURE 5

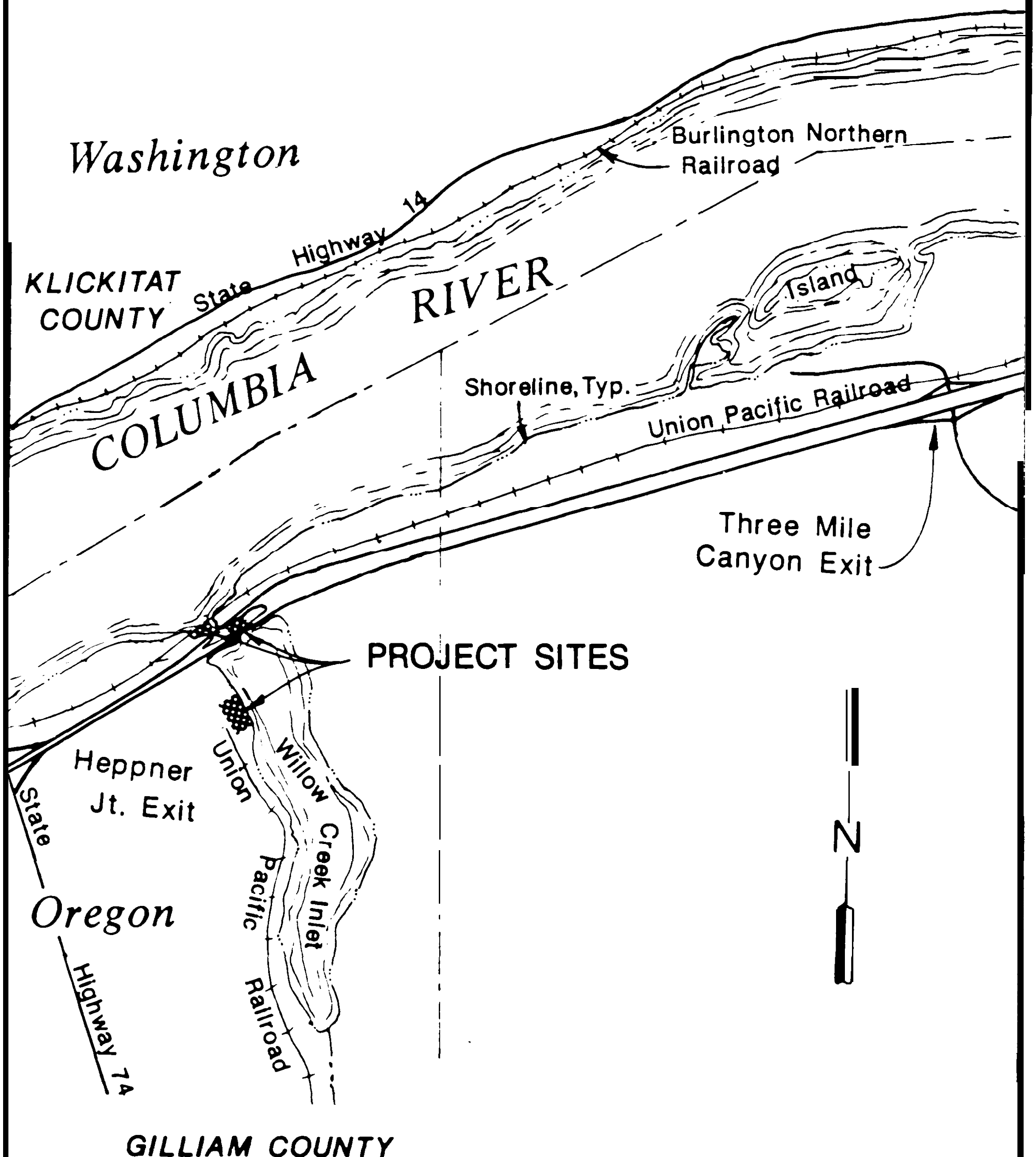



**VICINITY MAP**

**RINGOLD SPRINGS**

SCALE: 1cm=1km

FIGURE 6

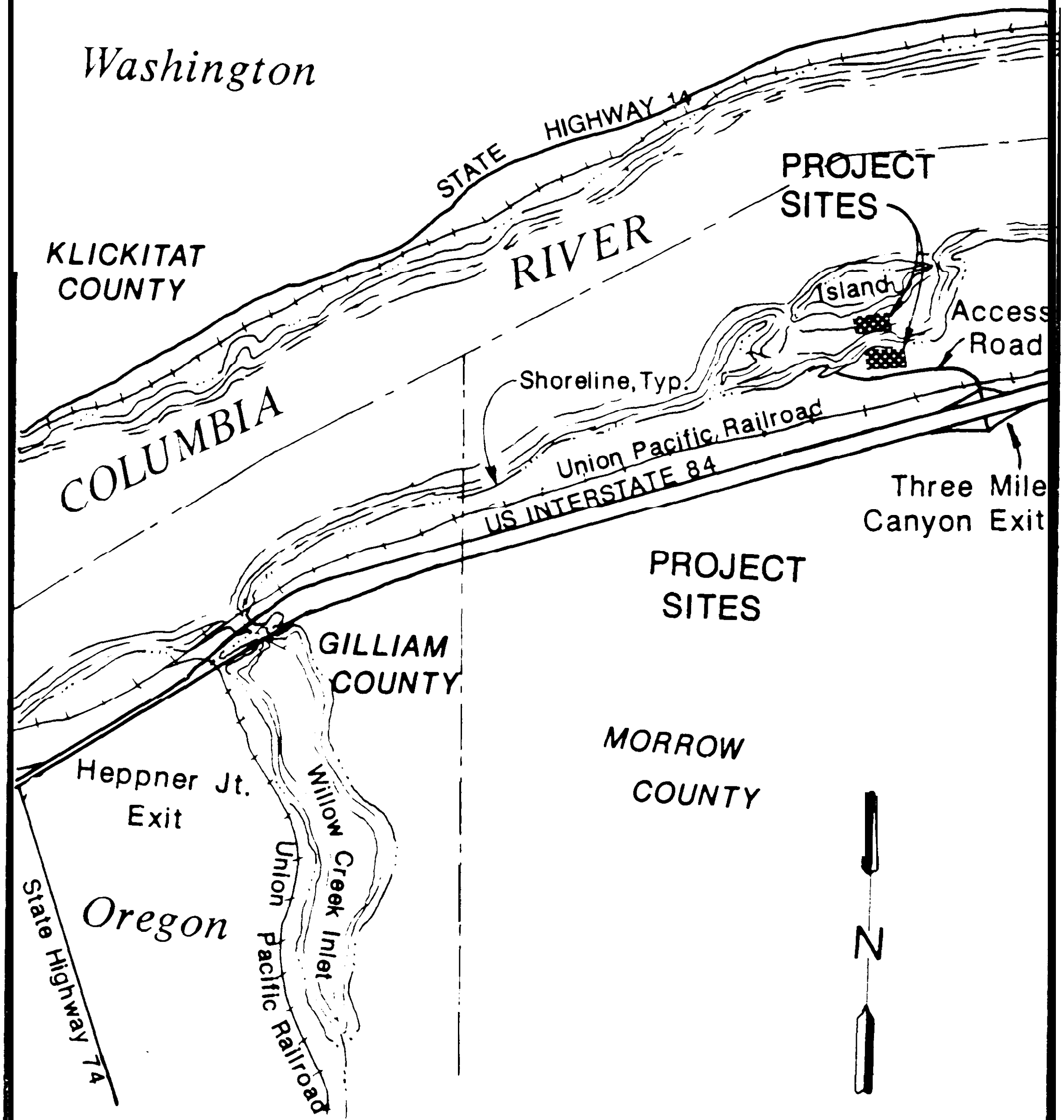



**VICINITY MAP**

**WILLOW CREEK**

SCALE: 1"=4000'

FIGURE 7

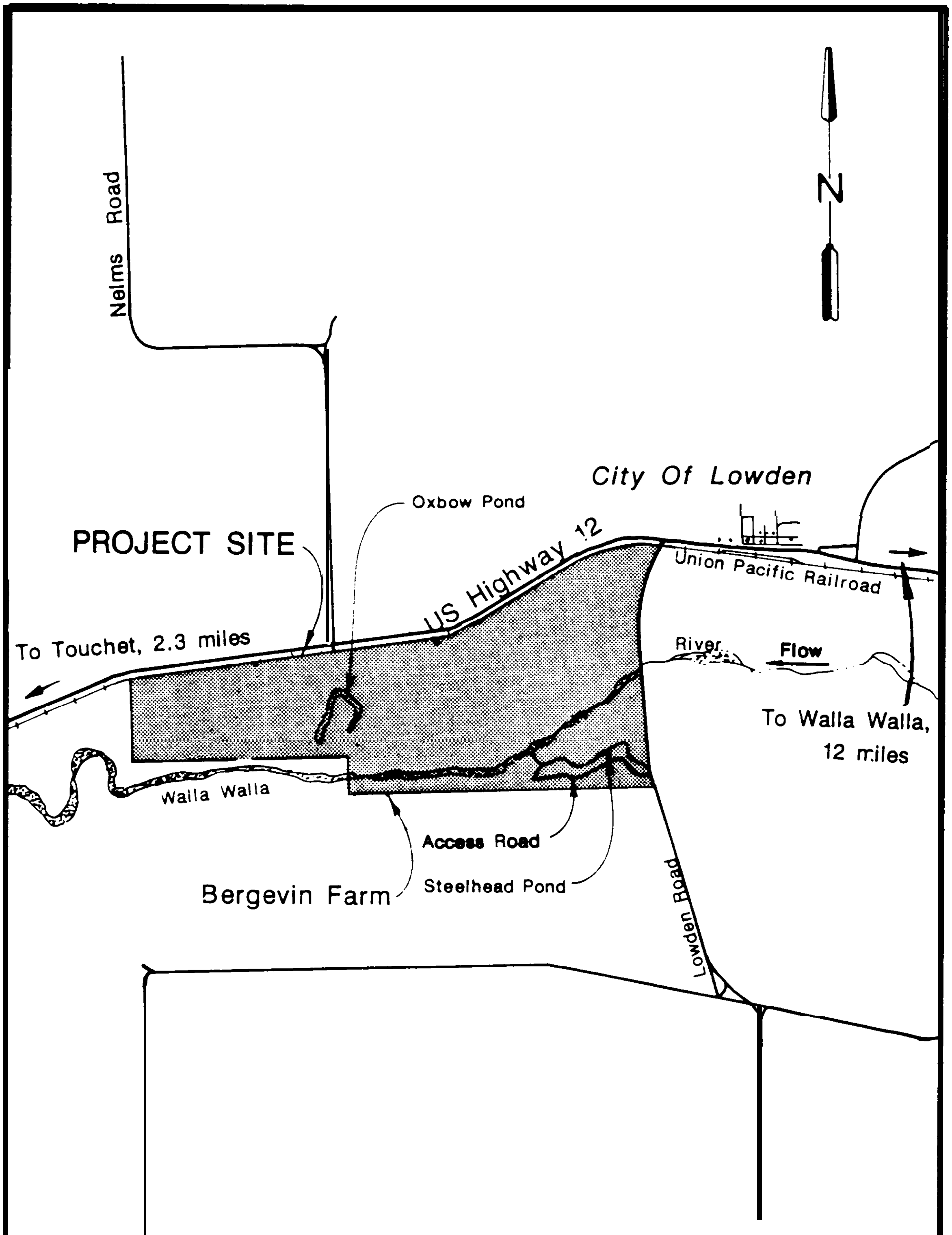



**VICINITY MAP**

**THREE MILE CANYON**

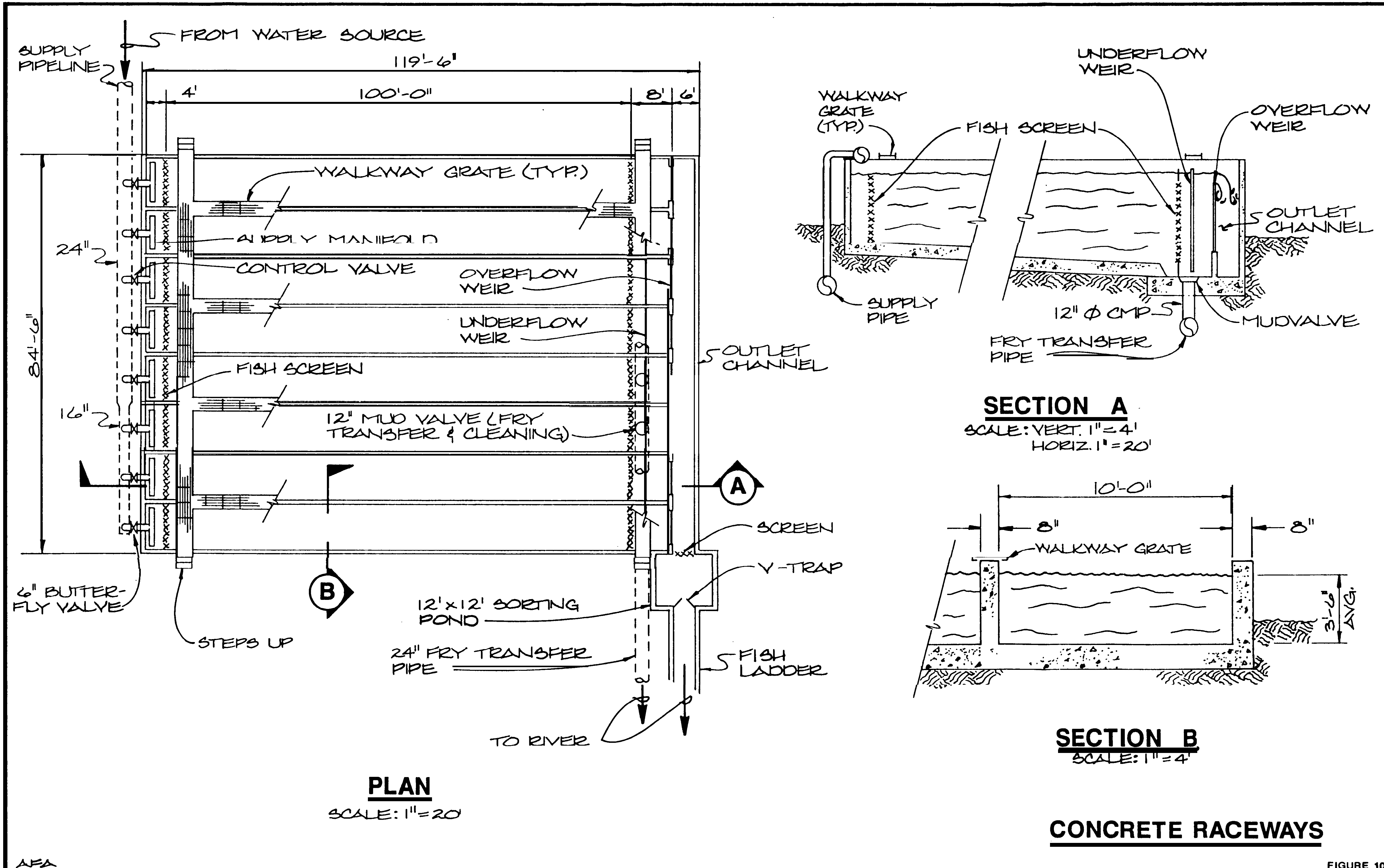
SCALE: 1"=4000'

FIGURE 8



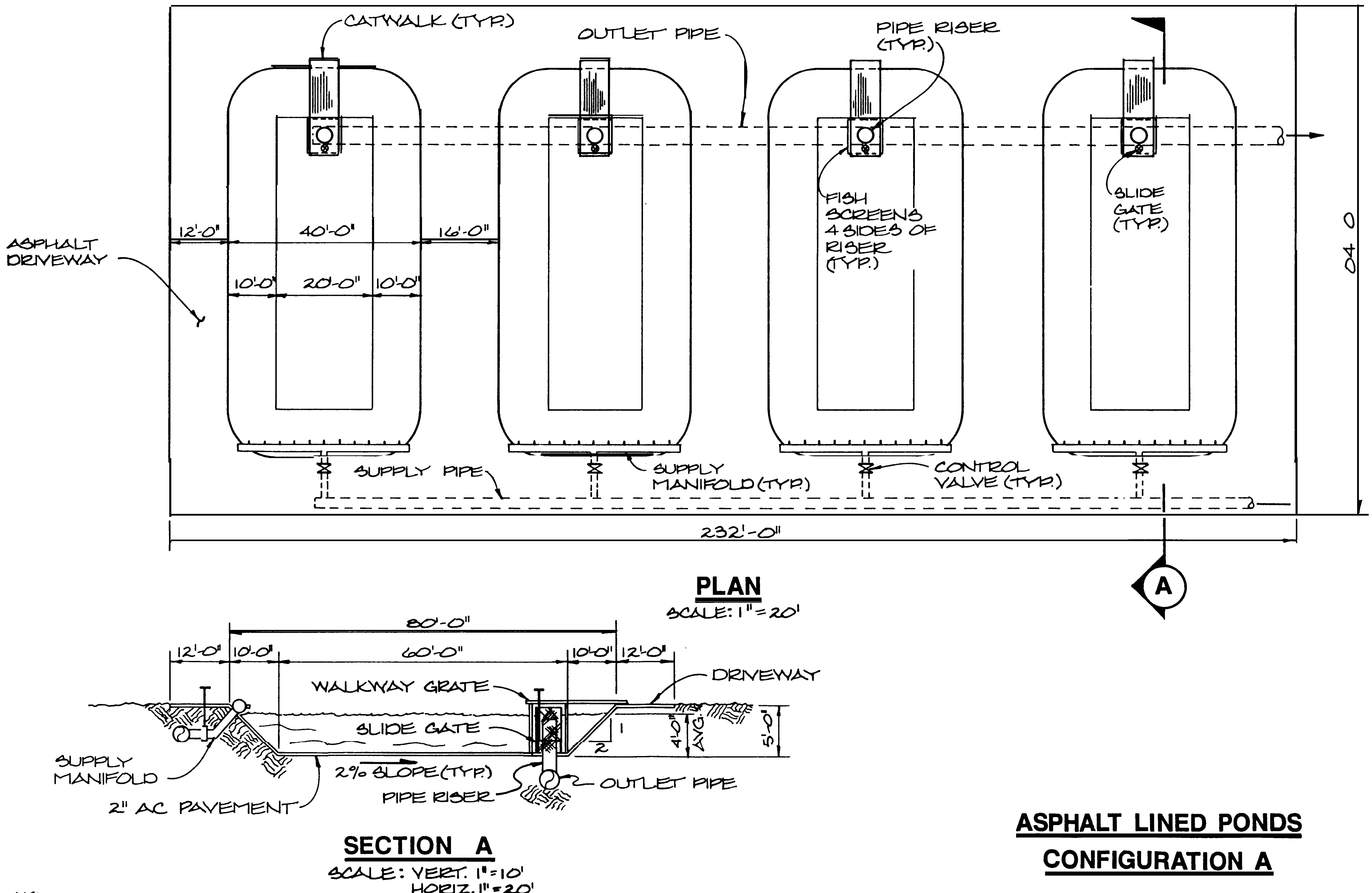

# VICINITY MAP
# WALLA WALLA
SCALE: 1"=2000'

FIGURE 9




**CONCRETE RACEWAYS**

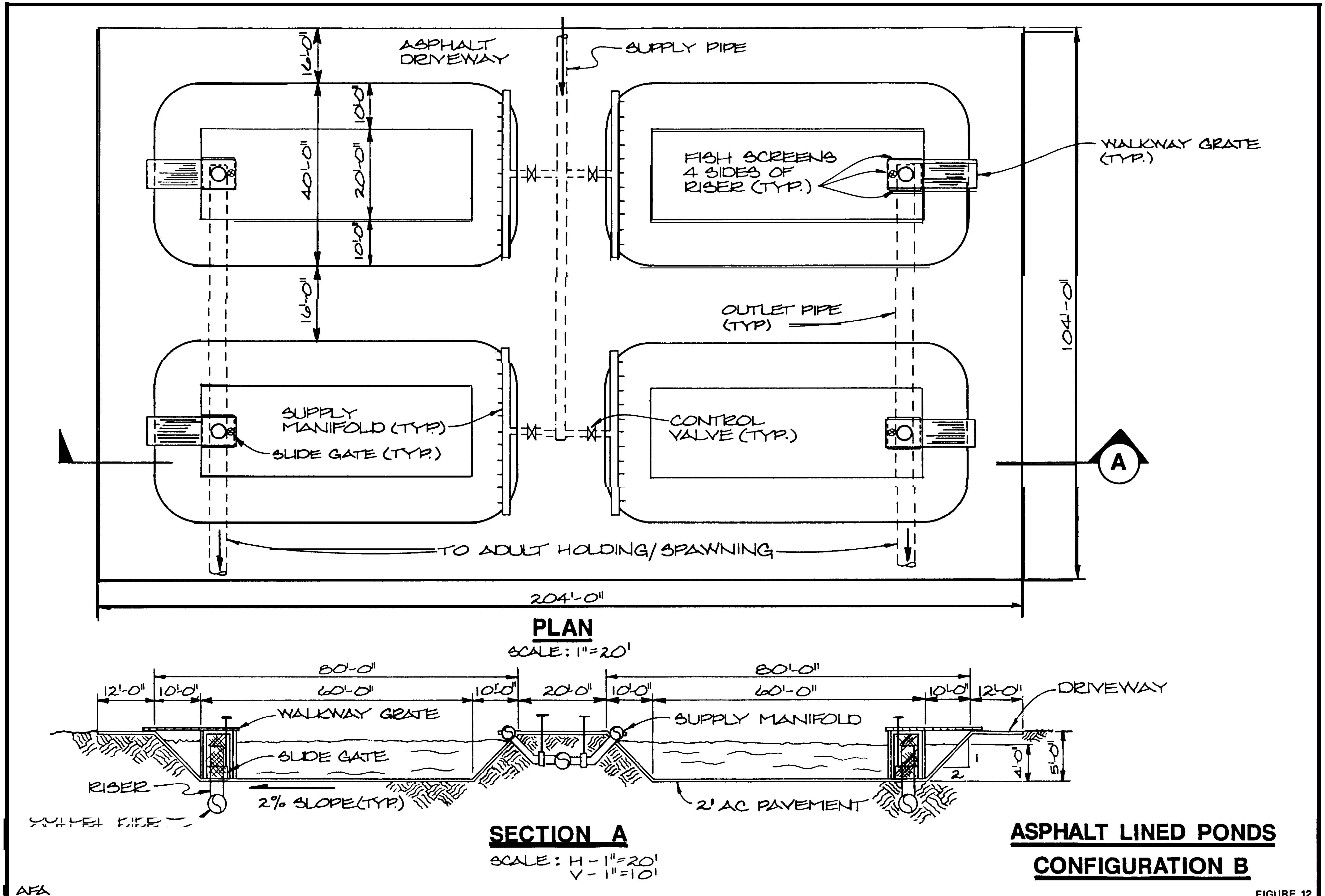
FIGURE 10




**ASPHALT LINED PONDS**

**CONFIGURATION A**

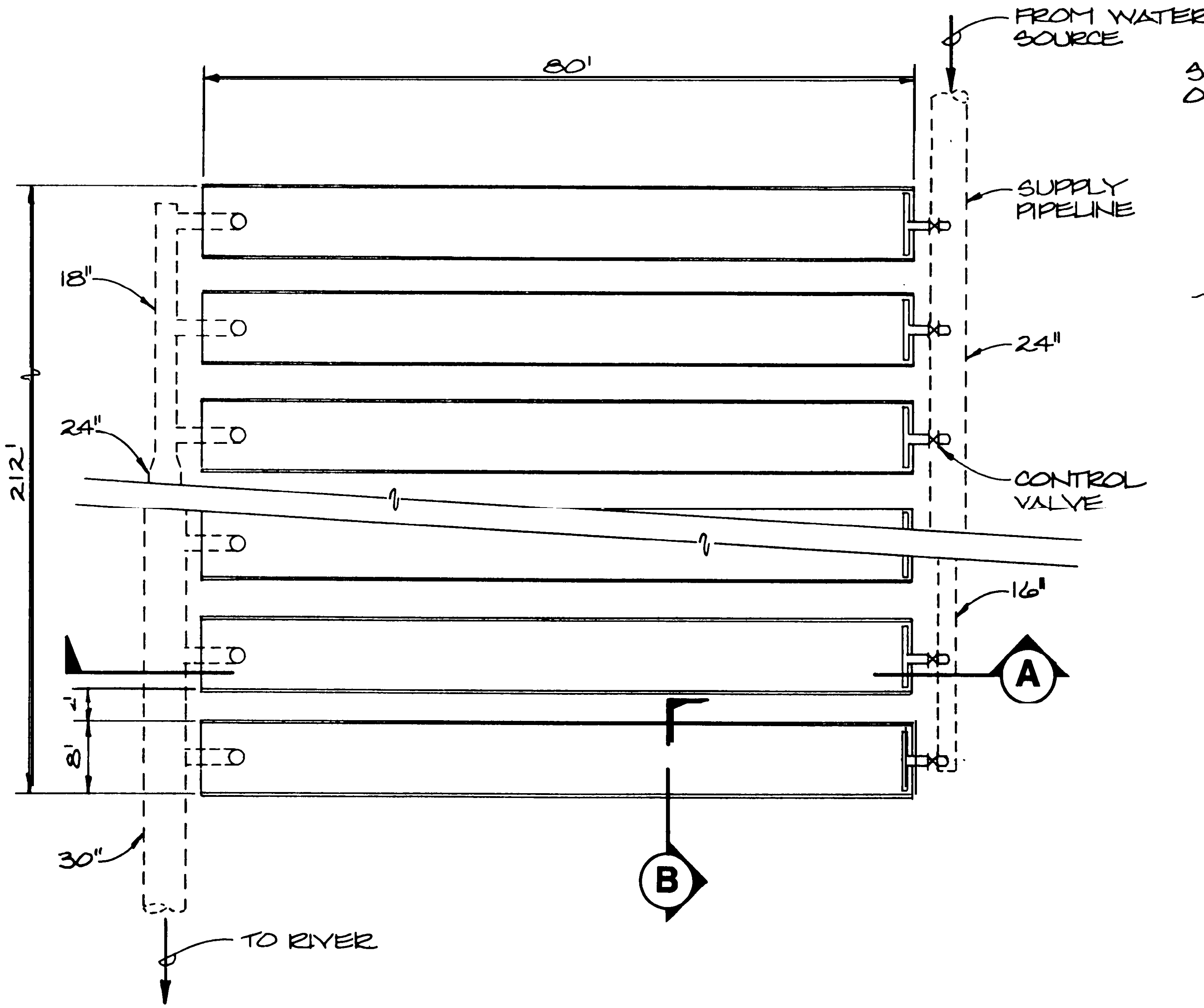
FIGURE 11



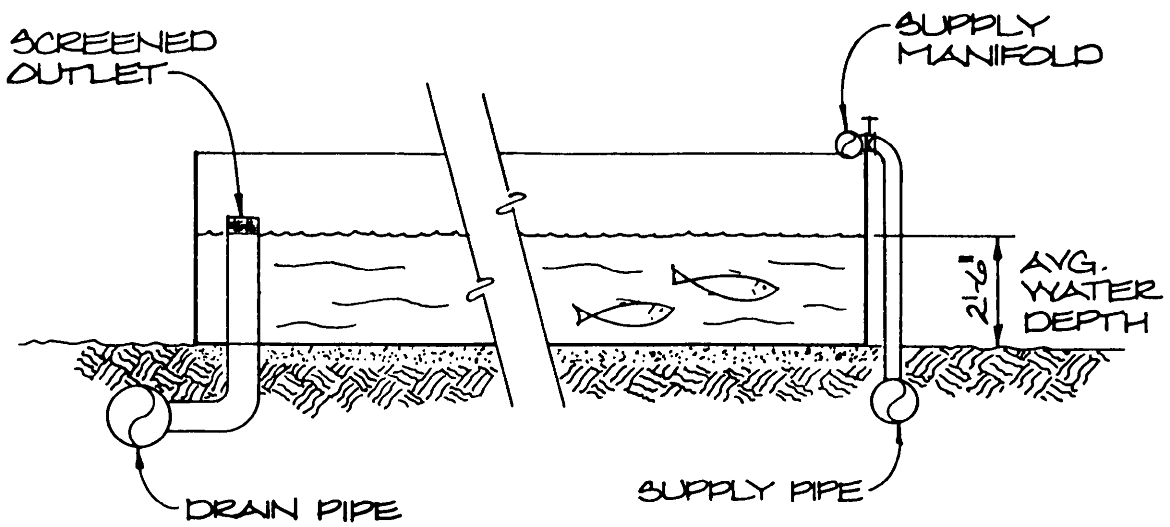

**ASPHALT LINED PONDS**

**CONFIGURATION B**

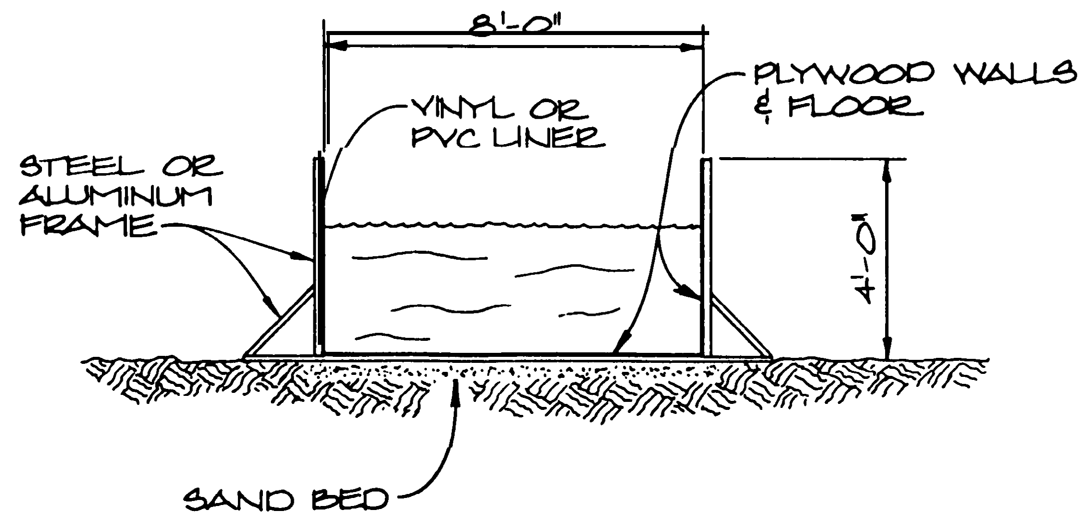
FIGURE 12




## PLAN
SCALE: 1" = 16'




## SECTION A
SCALE: 1" = 4'

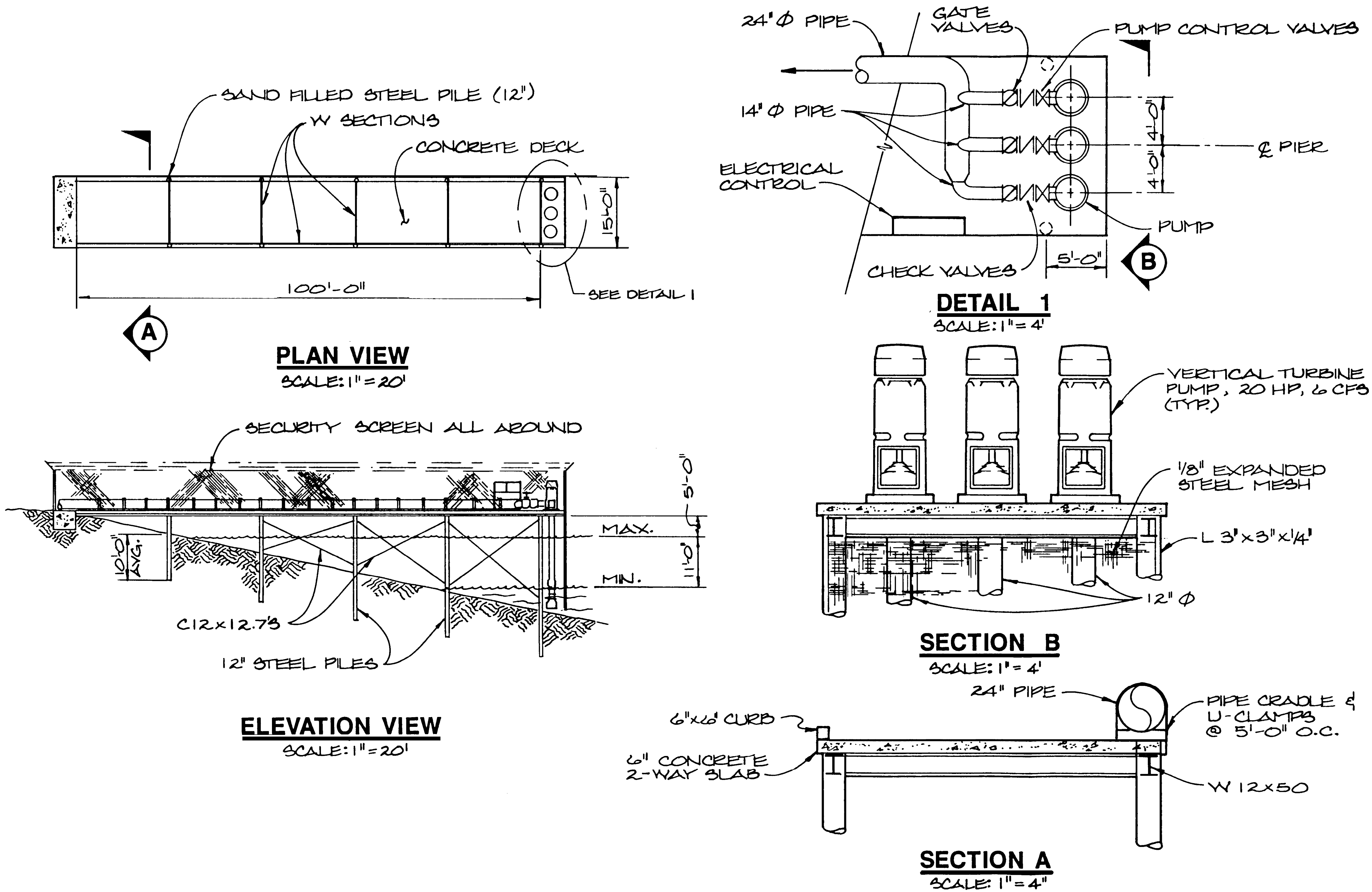



## SECTION B
SCALE: 1" = 4'

## VINYL RACEWAYS

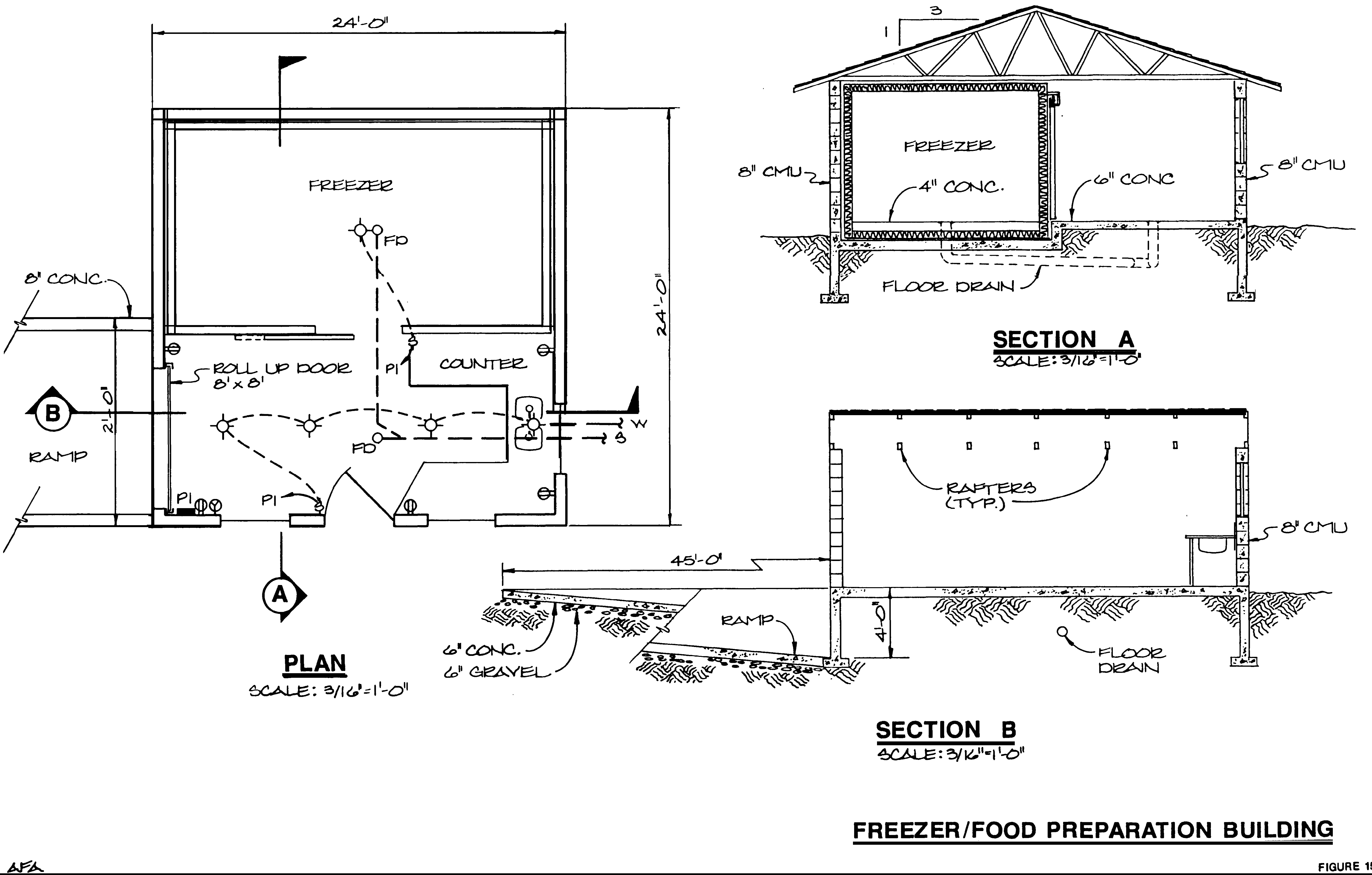
AFA

FIGURE 13



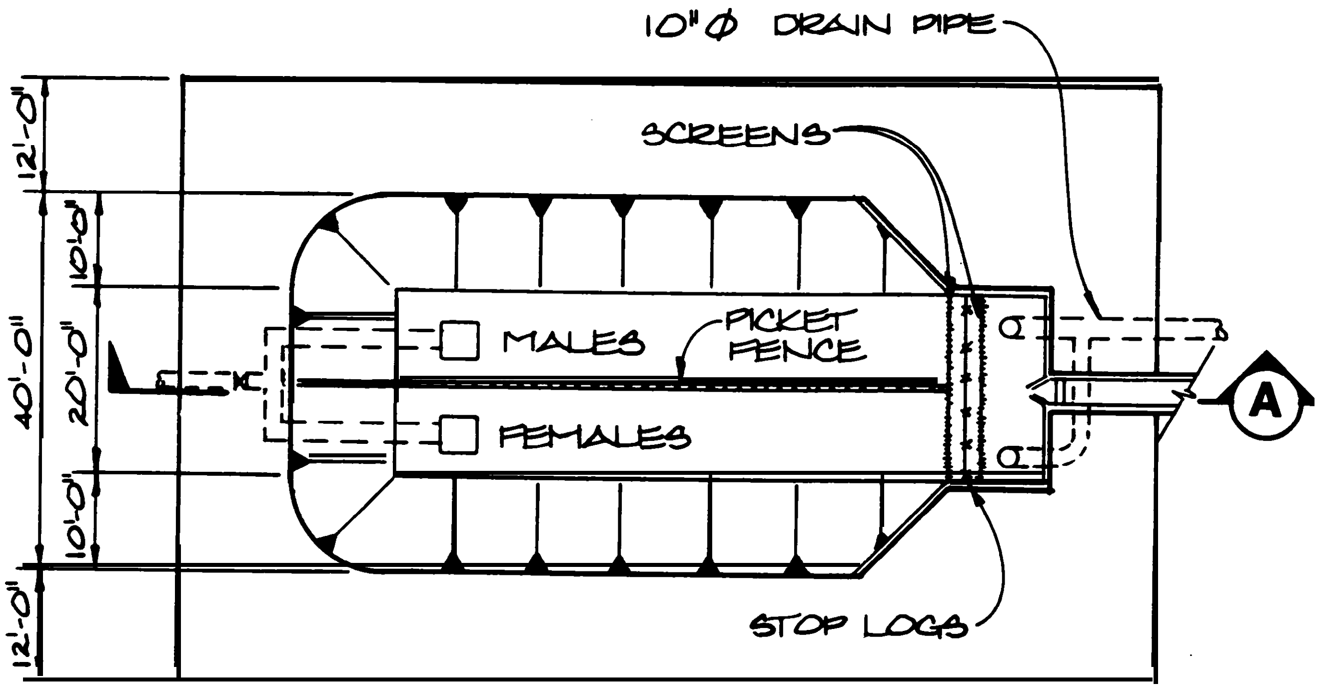

DETAILS--RIVER WATER PUMP STATION

FIGURE 14

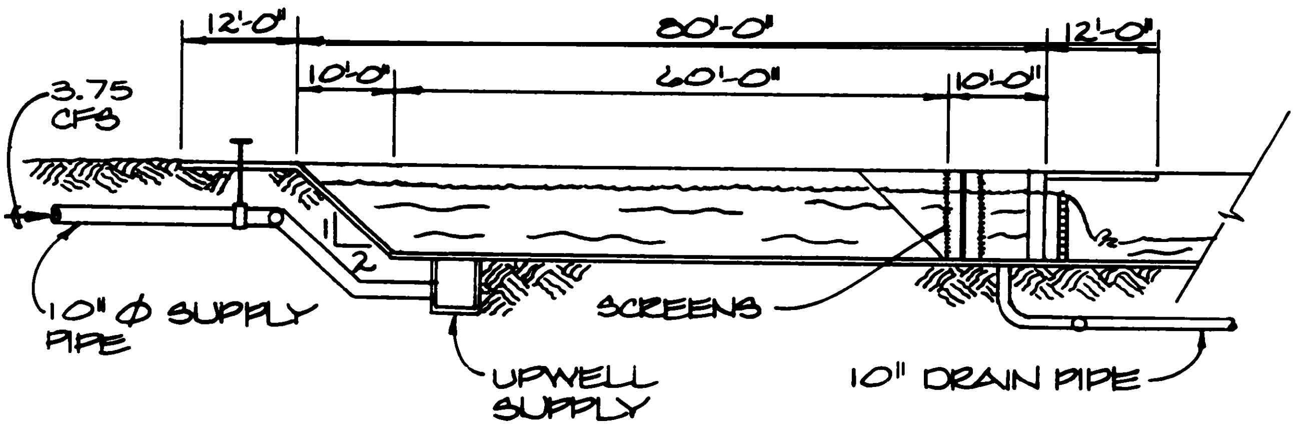



## FREEZER/FOOD PREPARATION BUILDING

FIGURE 15




**PLAN**
SCALE: 1"=20'




**SECTION A**
SCALE: 1"=20'

## ADULT CAPTURE/SPAWNING

AFA

FIGURE 16

# APPENDIX A

# CULTURAL RESOURCE OVERVIEW

Prepared for

Sverdrup Corporation
1200 - 112th N.E., Suite C
Bellevue, Washington 98009

# A CULTURAL RESOURCE OVERVIEW OF THE JOHN DAY ACCLIMATION PONDS PROJECT

by

Jeanne M. Welch, M.A.

July, 1987

Western Heritage
P.O. Box 6266
Olympia, WA 98502

TABLE OF CONTENTS

LIST OF FIGURES

## I. INTRODUCTION

A Cultural Resource Overview was conducted by Western Heritage under contract to Sverdrup Corporation for the John Day Acclimation Ponds Project. A Cultural Resource Overview is a broad-brush inventory of a large geographic area, based on previously known or recorded information. The objectives of an overview are to compile, in one document, all previously recorded data about the nature, distribution, and values of cultural resources in the area covered and to derive estimates on the likelihood of additional cultural resources existing in the area studied. The results of the overview are used as a basis for planning details of specific project areas and to comply with legal requirements to integrate land use planning with resource management (Wildesen 1977).

The John Day Acclimation Ponds Project consists of eight sites scheduled for development by the U.S. Fish and Wildlife agency, The sites are variously located on the Columbia, Yakima, and Walla Walla River systems. A general outline of the geology, prehistory, and ethnography will be considered for the area in which the proposed development sites occur. Previous archaeological investigations, pertinent history, conclusions and recommendations will be specific to the individual construction sites.

The construction sites include:

(A) The White Bluffs Ferry Site, Section 29, Tl4N, R27E, Locke Island Quadrangle, Wash.;

(B) The Ringold Springs Site, Sections 23, 24, T12N, R28E, Savage Island Quadrangle, Wash.;

(C) The Sunnyside Dam Site, Section 28, T12N, Rl9E, Wapato Quadrangle, Wash. ;

(D) The Prosser Site, Section 36, T9N, R24E, Prosser - Whitstran Quadrangles, Wash. ;

(E) The Walla Walla Site, Section 30, T7N, R34E, Lowden Quadrangle, Wash.;

(F) The Hat Rock Pond Site, Section 14, T5N, R29E, Hat Rock Quadrangle, Wash.-Oreg.;

(G) The Three Mile Canyon Site, Section 20, T4N, 23E, Alderdale Quadrangle, Wash.-Oreg.; and

(H) The Willow Creek Backwater Site, Section 36, T4N, R22E, Heppner Junction Quadrangle, Oreg.-Wash.

Rob Whitlam, State Archaeologist, of the Washington State Office of Archaeology and Historic Preservation and Lee Gilsen, State Archaeologist, of the Oregon State Historic Preservation Office were contacted for data about cultural resources in the various project areas. John Leier, Archaeological Coordinator, Corps of Engineers, Walla Walla District, and Rob Freed, Archaeologist, Corps of Engineers, Portland District, and David G. Rice, Archaeologist, Corps of Engineers, Seattle District, also were consulted for any additional information related to the proposed project sites.

## II. GEOLOGY

Columbia basalts of the middle Miocene period comprise the geological formations in the general project area. The base of the massive, dense flows found in the region are colored a dark gray. Oxidized, weathered rock formations, shaded various hues of red and brown, are seen in the upper portions of these lava flows. The flows in the immediate area vary in thickness from 20 to 100 feet and are distributed extensively on a horizontal plane. Overlying these basalts are a complex of aeolian sediments in the uplands and away from the streams; flood-deposited sediments associated with glacial Lake Missoula and/or Lake Bonneville floods; lacustrine sediments of Pleistocene age and presuned to have resulted from vast impoundments of the Columbia River; colluvial deposits along the stream valley margins; and alluvial sediments in the stream valleys.

A portion of the proposed construction sites lie in approximately the center of that part of the Columbia River Basin known as the Inland Empire, which includes northeastern Oregon and eastern Washington. To the east and southeast lie the Blue Mountains and the Wallowa Mountains; to the west is the Cascade Range; to the north is the Columbia Basin; and the Palouse Hills are in the northeast. Drainages from the nearby slopes of these mountains and the Big Bend plains ultimately flows into the Columbia River. The mountains are steep, occasionally rugged, and generally heavily timbered. Prominent mountain peaks, such as Mt. Rainier, Mt. Adams, and Mt. Hood, are visible from points within the Inland Empire and rise to elevations well above timberline. The plateau, plains areas, and lower mills, such as the Horse Heaven Hills. Rattlesnake Hills, and Saddle Mountains, are devoid of timber. Extensive areas, generally lying along the river and its tributaries, are flatlands, which today are devoted to dryland and irrigated faming (taken from the U.S. Army Corp of Engineers, McNary Master Plan, December 1981, Design Memorandum No. 24).

## III. PREHISTORY

Leonhardy and Rice (1970:4-6) distinguished five temporal and technological sequences on the basis of slight changes in artifact assemblages and stratigraphic information. These phases, from oldest to most recent, are the Windust, Cascade, Tucannon, Harder, and Numipu Phases.

The Windust Phase, which dates from approximately 10,000 to 8,000 years ago, is characterized by artifact assemblages that include

> a variety of closely related short blades, shoulders of varying prominence, principally straight or contracting stems, and straight or slightly concave bases. Both uniface and biface lanceolate points occur but are exceedingly rare. Most knives are large lanceolate or oval forms and are relatively crudely made. End scrapers are large and usually of poorly defined form. They are rare in all the assemblages. Single and multiple faceted burins occur in small numbers. Utilized flakes are the most numerous and most varies lithic artifacts. Cobble tools include large scraping planes, uniface and biface choppers, large scraper-like implements, and utilized spalls. Bone artifacts are few, but include needles, atlatl spurs, tips of awl-like implements, and fragments of small round shafts (Leonhardy and Rice 1970:4).

The predominant lithic material used during this period is cryptocrystalline, and manufacturing techniques were sophisticated and well developed.

The Cascade Phase, which dates from about 8,000 to 5,000 years ago, consists of six categories of tools: knives, scrapers, projectile points, pounding tools, chopping tools, and bone tools. The Cascade Phase has been subdivided by Butler (1962: 19-20) into early and late subphases, with the temporal division determined by the occurrence of Mazama ash (ca. 6,700 B.P.). In the early Cascade tool assemblages, the predominant projectile point type is lanceolate, while the later subphase contains lanceolate and large side-notched points in almost equal amounts.

The Tucannon Phase assemblages of the Columbia-Lower Snake River region, which fall between 5,000 and 2,500 years ago, have been found associated with the first evidence for large village sites. Leonhardy and Rice noted that the lithic technology of this phase is not as well developed as those of the preceding and following phases. The Tucannon assemblage consists of

> Two kinds of projectile points, the first has a short blade, shoulders of varying prominence, and a contracting stem. The second variety is notched low on the side or at the corner to produce an expanding stern and short barbs. In addition to the projectile points, there are small side scrapers and end scrapers, numerous scraper-like cobble implements, utilized cobble spalls, and pounding stones. Sinkers, hopper mortar bases, and pestles occur. Interestingly enough, well-formed knives are virtually absent in all components. Utilized flakes are neither as nunerous nor as large as those in components of earlier phases. Bone and antler implements include splinter and split metapodial awls, fragments of awl-like implements, and an antler wedge. A bone shuttle found at the Tucannon site indicates net making (Leonhardy and Rice, 1970:11).

The Harder Phase that follows dates from 2,500 B.P. up to the ethnographic period. The assemblage is divided into early and late subphases on the basis of projectile point size, hut the division is unclear. In general, Harder Phase projectile points become smaller and more delicate with the passing of time. Other artifacts characteristic of the assemblage include a variety of scrapers, lanceolate and pentagonal knives, an abundance of cobble spalls and sharp angle cobble tools, pestles, hopper mortar bases, sinkers, bone awls, needles, circular and pendant beads, perforated elk teeth, and gaming pieces (Leonhardy and Rice 1970:20).

Daugherty notes the II.. . the culture history of the Colmbia-Lower Snake River Region can be characterized by slow gradual change, involving principally the accretion of new elements with little loss or replacement of the old. Broadly speaking, this pattern of cultural change is characteristic of the Intemontane West? (Daugherty 1963:25).

## IV. ETHNOGRAPHY

The White Bluffs, Ringold Springs, Sunnyside and Prosser Site areas are within the lands ascribed to the Wanapun and Yakima peoples. Ethnographic data gathered about these Sahaptian speaking people by Relander (1956), Ray (1939) and Smith (1982) indicate that they occupied similar environmental niches and utilized resources found in the area in a like manner.

The Indians camped close to the Columbia during the annual fish runs then left the river in the spring for the uplands to gather wild onions, carrots and root crops including kouse and camas. Hunting activities also occupied their time as they sought elk, deer, and bear along with smaller game, such as rabbits, ground squirrel and birds. Toward fall, large quantities of berries were gathered and preserved, to be added to the winter larder. The fall fish runs brought about a return to the river valley settlements.

The sedentary winter villages were located in the river valleys and were concentrated near the confluence of major tributaries to the Columbia. Semi-subterranean pit houses and mat lodges were characteristic housing styles that were noted among the Indians by early explorers to the area (Thwaites 1959). Mat lean-to? sufficed for shelter in the temporary outlying campsites.

Fishing and hunting areas were shared by both the Wanapum and Yakima, and intergroup gatherings, trading sessions and intermarriage were prevalent among these peoples who shared a common language and economic base.

The Walla Walla, Hat Rock, Three Mile Canyon and Willow Creek Site areas were occupied by the Umatilla, Walla Walla, and Cayuse Indians.

Osborne (1957:164) placed the Umatillas on "both sides of the Columbia from just east of Arlington, Oregon to just west of the mouth of the Walla Walla River." On the other hand, Berremen (1937:162) states that, prior to 1750, the Salish-speaking Moses-Columbia group occupied the south bank of the Columbia from The Dalles to the crest of the Blue Mountains, but they appear to have been displaced by the Umatillas by the early 1800s. The Cayuse Indians, neighbors to the Umatillas, inhabited the lands south of the Snake River that border on the present-day Lower Monumental and southern portion of the Little Goose Reservoirs, as well as on portions of the Grande Ronde River in Oregon. The Cayuses, Umatillas, and Walla Wallas all were Sahaptin-speaking peoples and had established friendly relations with one another.

Hunting and gathering, heavily supplemented with fishing on the Columbia and Snake Rivers, characterized the economic base of the early inhabitants of the area. The gathering of roots, berries, seeds, pine nuts, and other vegetable foods; the hunting of elk, antelope, and deer; and the netting, trapping, and spearing of fish occupied the populations year round.

Resource potential and natural shelter dictated the placement of winter villages and the outlying seasonal camps used for foraging, hunting, and fishing. Housing consisted of multifamily dwellings, rectangular longhouses, and semisubterranean pithouses. Lean-to frames covered with matting served as temporary dwellings during the summer and spring activities.

Discrete geographic boundaries among the Umatillas, Cayuses, and Walla Wallas cannot be distinguished, because they often intermarried and shared similar social and political, and subsistence systems (Brauner 1976:3).

Osborne (1957:167) notes that centralization of power and tribal organization did not exist and that authority was vested in local families or groups. This system may have changed with the introduction of the horse into the region in the 1730s. There is no doubt that equestrian mobility had a profound impact on the entire social system. Foragers and hunters rangd greater distances and used pack horses for transport of the resources gathered. An increase in the gathering of subsistence resources most likely led to a surplus, which in turn engendered increased interregional barter and trade. It is reasonable to assume that, with the coming of the horse, territorial boundaries took on greater significance and local autonomy gave way to centralization of authority in tribal chieftainships.

The ethnographic record pertaining to the Umatillas, Cayuses, and Walla Wallas is rather sparse; major contributions include those by Ray (1936,13391, Ruby and Brown (1972), Osborne (1957) and Smith (1953). A summary of the ethnography of these three tribes was completed by Robert J. Suphan (1974) for the Indian Claims Commission. The gathering of additional data through archaeological research cannot help but increase our knowledge about the Native American populations who inhabited and utilized the area in the past.

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Wildesen, Leslie E.
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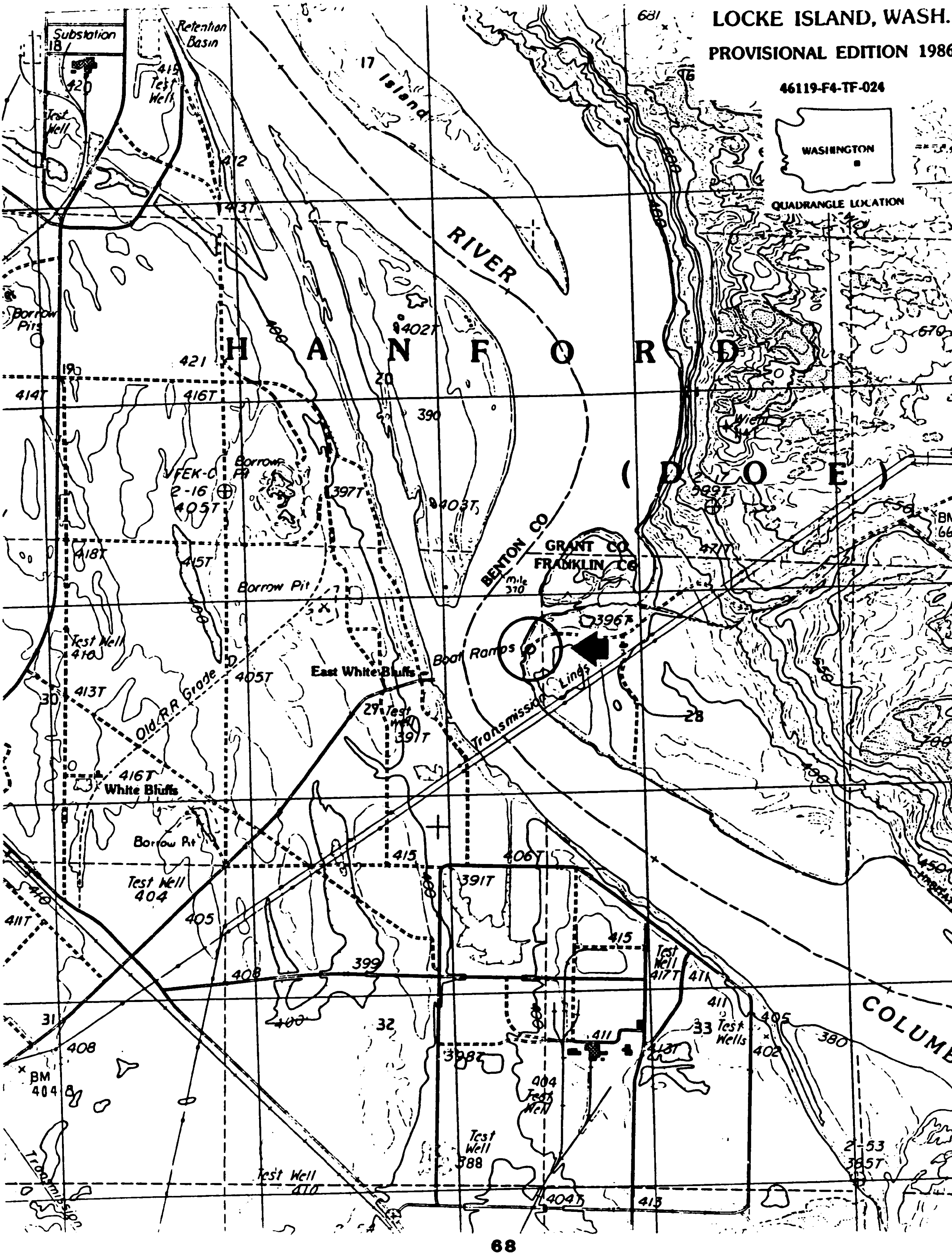
Figure 1. (A) The White Bluffs Ferry Site,
Section 29, T14N, R27E,
Locke Island Quadrangle, Mash.


LOCKE ISLAND, WASH.
PROVISIONAL EDITION 1986
46119-F4-TF-024
WASHINGTON
QUADRANGLE LOCATION
Substation
Retention Basin
Test Well
Island
RIVER
HANFORD
(DOE)
Borrow Pit
FEK-C 2-16
BENTON CO
GRANT CO
FRANKLIN CO
Boat Ramps
East White Bluffs
Transmission Lines
Old R.R. Grade
White Bluffs
Test Wells
COLUMB

A. WHITE BLUFFS FERRY SITE

Previous Investigations

A regional archaeological survey of the Mid-Columbia was conducted by H.W. Krieger in 1927. Following World War II, the Smithsonian River Basin Survey team specifically, Drucker (1948); Campbell (1950) and Shiner (1951) continued survey studies. David G. Rice began a preliminary reconnaissance of the area in 1968 for the Department of Energy followed by intensive surveys conducted in 1980 and 1983 which included the White Bluffs Ferry Site. "Tacht", one of the Wanapum Indians principal, sedentary villages was directly across the Columbia River on the west bank and was named for the geologically significant bluffs.

As a result of his work, Rice identified a prehistoric and historic site at White Bluffs Ferry. A fishing station, 45.FR-266, consisted of scattered concentrations of camp rock. Artifacts noted were cobble tools, notched pebble sinkers, pestles, small corner-notched points, and a clam shell disk bead.

Historic components of the site included a log cabin which was used as a blacksmith% shop in pioneer days and subsurface remains related to the "Hudson Bay House". The cabin is still standing on the site and is fenced to protect the historic structure. The "Hudson Bay House" was built on top of the prehistoric site, but no trace of the building remains today. Rice (1983) stated:

> The structure was an earlier remnant of an 1860s mining era settlement described by Splawn (1917:221). The house was thought to have been a warehouse for goods during the gold rush. The name derives from an American at White Bluffs who received goods by steamer and then sent them by pack train to the gold mines in the Colville District under license with the Hudson% Bay Company (after the boundary settlement of 1846, the Hudson's Bay Company continued to operate in the United States for a number of years).

The entire archaeological/historic site area measures sane 610 m long and 150 m wide.

History

The history of White Bluffs Ferry Site is tied to the discovery of gold in Idaho; in the Colville District in the late 1850s and in the 1860s in the Caribou District of British Columbia. To facilitate the crossing of the Columbia River by travelers, miners, and freighters, ferries and encampments were established in the 1860s. In his report, Overview of Cultural Resources on the Hanford Reservation in South Central Washington State, David G. Rice has succinctly summarized the reason for the rapid growth of White Bluffs.

The storehouses of an abandoned military depot at White Bluffs were occupied soon after their abandonment by one Thomas Howe who established a ferry across the Columbia at that location in 1861 (Rice 1976:4; Parker 1979:13). By 1863 Howe was gone, but A.R. Booth arrived in White Bluffs and operated a trading post, a way station and ferry. The early settlement at White Bluffs was in a propitious location. The Caribou Trail which intersected White Bluffs was the end point of the river travel for miners and the beginning of their overland travel to the gold fields. When the steamship, Colonel Wright, took a load of miners and their supplies to Priest Rapids on their way to Similkameen in northern Okanogan, The Portland Oregonian reported the economic outlook on March 1, 1866 (Rice 1980):

> A second Sacramento; we are informed that a company has been formed at The Dalles that intends putting 25 heavy freight teams on the portage from White Bluffs to Pende Oreille at once and increase the number as we see another very important link in the communications with Montana supplies. We have ever looked upon White Bluffs as a starting point in this great trade, and we have no doubt that, relying on the

> merits of the route above, will continue to prosper, and it may become in time the Sacramento of the Columbia Valley.
>
> Already a hotel and several stores have been established there. The pioneers of the town, Booth and Nevison, have already purchased a very extensive stock of goods. The town is to be properly surveyed, now that permanency is no longer a matter of doubt.

Between 1858 and 1886, the Caribou Trail which intersected the White Bluffs area led miners from Wallula north into Canada through the Okanogan Valley. By the 1860s wagon roads were constructed between White Bluffs and Fort Colville to transport supplies to the gold mines and steamships also traveled the Columbia from Portland to White Bluffs carrying supplies for the mines. What had been the site of a military depot at the White Bluffs, used during the Indian Wars (1855-58), became a small settlement in the 1860s complete with warehouses and saloons. However, when the Mullan Road from Fort Walla Walla to Fort Benton, Montana was constructed between 1859-1863, the road bypassed the rapids of the Columbia and the miles of loose sand between White Bluffs and Pend Oreille. Walla Walla City became the main supply route to the gold mines. Although this lucrative source of revenue vanished, the White Bluffs economy, based on agriculture, stabilized and survived. White Bluffs revived operation of a ferry system in the late 1800s and in 1900 ran a horse-powered paddle wheel ferry, but by the end of the 1920s steamers on the Columbia ceased to operate and ferries gave way to bridges and travel by car.

## Conclusions and Recommendations

The White Bluffs Ferry Site has been disturbed by construction of a ditch wasteway by the Bureau of Reclamation, a power line by the Bonneville Power Administration and fisheries enhancement projects in the past. However, the prehistoric and historic past of the area is significant and it is highly probable that intact deposits still exist that would be subject to impact by the proposed construction. Western Heritage recommends that a professional archaeologist monitor the proposed construction activities.

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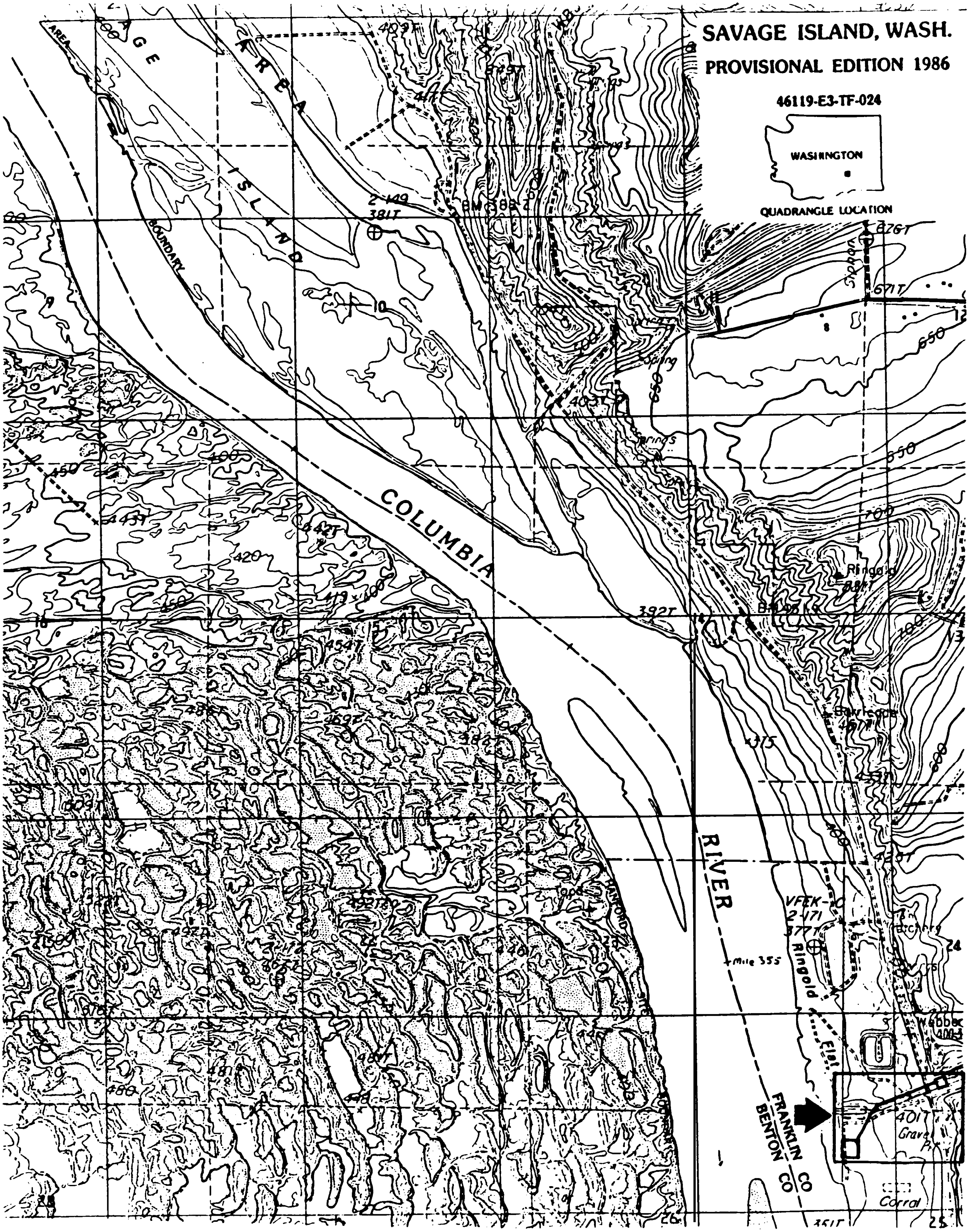
Splawn, Andrew Jackson

1917 Ka-mi-akin: last hero of the Yakimas. Portland, Oregon: Kilham Stationery and Printing Company.

Figure 1. (8) The Ringold Springs Site, Sections 23, 24, T12N, R28E, Savage Island Quadrangle, Wash.


SAVAGE ISLAND, WASH.
PROVISIONAL EDITION 1986
46119-E3-TF-024
WASHINGTON
QUADRANGLE LOCATION
COLUMBIA
RIVER
ISLAND
AREA
BOUNDARY
Ringold
Ringold
Flat
Springs
Spring
Corral
Gravel Pit
FRANKLIN CO
BENTON CO
Mile 355
VFEK-10
2-171
377T
2-149
381T
BM 388
392T
401T
403T
431T
442T
420
450
550
650
700
800

## B. RINGOLD SPRINGS SITE

### Previous Investigations

There were no early surveys of the project area because that portion of the Columbia River between the Vernita Bridge and Ringold was controlled by the Atomic Energy Commission and was closed to public access. The first survey work in the project area was carried out by David G. Rice from June 1968 to October 1968 in connection with the proposed Ben Franklin Dam which was to be placed north of Richland (Rice 1968). Although Rice identified 23 archaeological sites with three located on Savage Island, only one site, 45-FR-257, was found on the eastern bank of the Columbia downstream from Savage Island. This site which is just north of the Ringold Site consisted of concentrations of camp rock, cobble tools, notched pebble sinkers, hopper mortars and a shaft smoother. Rice stated that aerial maps were used to determine those areas with high probability for the occurrence of cultural resources. These areas were subjected to intensive survey but elevations above 400 feet were not included in the survey (Rice, Personal communication 1987).

### History

Various derivations for the name of Ringold community have been put forth. Hitchman (1985) states that the location was first known as Koontz Flat and that the Ringold designation reportedly honors an early stockman whose cattle grazed in the the adjoining countryside. On the other hand, Ramsey (1967) reported that Ringold was named for a Chinaman who panned gold on the opposite river bank about the turn of the century. It is not clear if he made his fortune at the prospecting or whether his name was "Rin" and thus, combined with "gold" to name the local area.

The community of Ringold began about 1906 as an agricultural community of dry-land wheat fanners who varied the grain with hay, fruit and vegetable crops. The advent of irrigation sustained the community after the lean dry crop years. Mail arrived and left on steamboats via a route established in 1909. In 1911, a motor launch known as the “Hanford Flyer” under the helm of a Captain Brown distributed mail along the Columbia River from Pasco to White Bluffs, but water-borne carriers gave way to cars in the 1920s.

Today Ringold Flat houses a Washington State Department of Fisheries Installation.

Conclusions and Recommendations

In the event that construction is initiated to the south of the Washington State Department of Fisheries present installation, Western Heritage recommends that this Ringold Springs area be investigated for cultural remains prior to construction.

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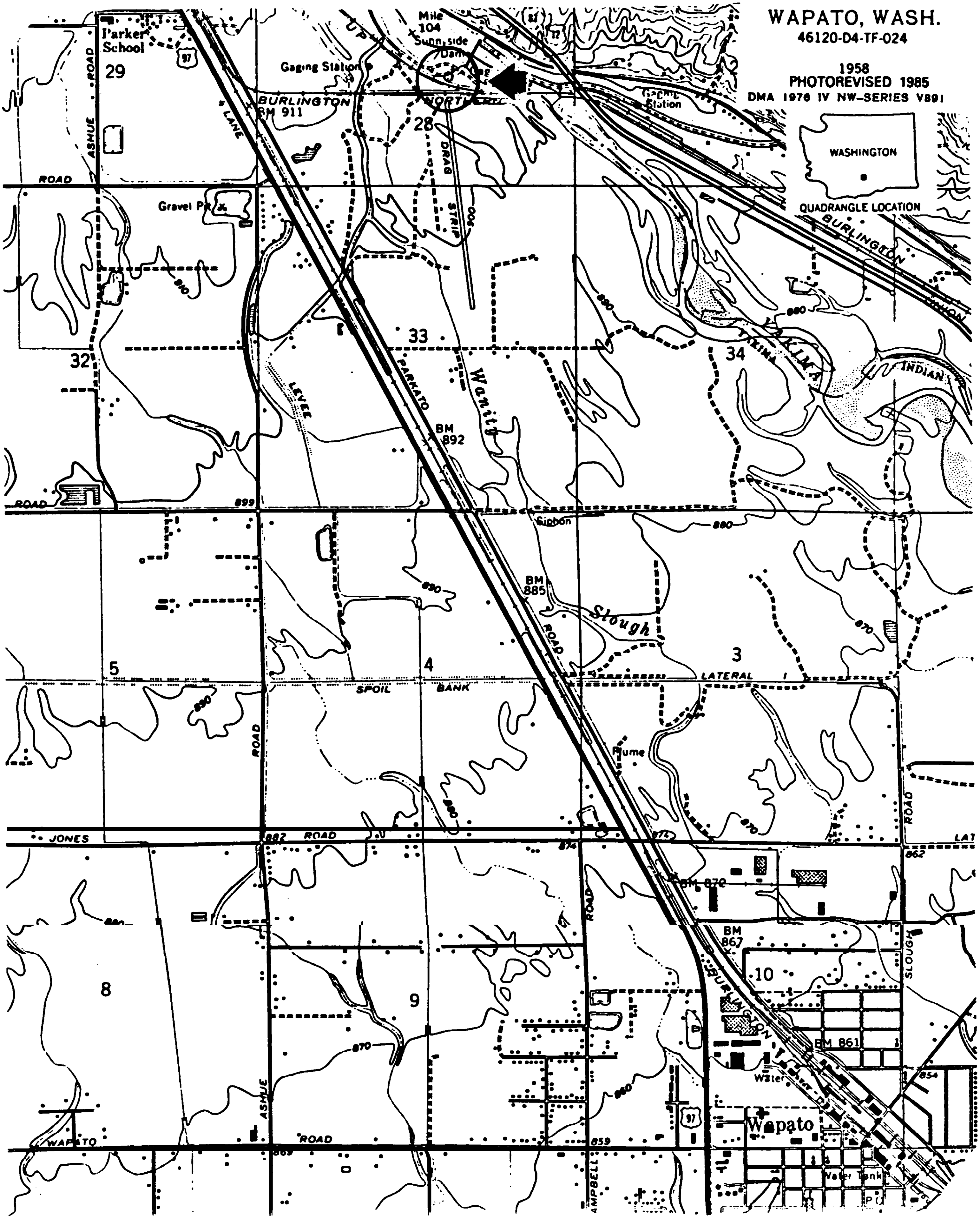
Rice, David G.
1968 Archaeological Reconnaissance Ben Franklin Reservoir Area, 1968. Washington State University, Laboratory of Anthropology, Pullman.

Figure 1. (C) The Sunnyside Dam Site,
Section 28, T12N, R19E,
Wapato Quadrangle, Wash.


WAPATO, WASH.
46120-D4-TF-024
1958
PHOTOREVISED 1985
DMA 1976 IV NW–SERIES V891
WASHINGTON
QUADRANGLE LOCATION
Parker School
Mile 104
Gaging Station
BURLINGTON
BM 911
LANE
ASHUE ROAD
ROAD
Gravel Pit
DRAG STRIP
BURLINGTON
YAKIMA
INDIAN
PARKATO
LEVEE
Wanity
BM 892
Siphon
BM 885
Slough
ROAD
LATERAL 1
SPOIL BANK
Flume
JONES ROAD
BM 870
BM 867
BURLINGTON
BM 861
Water
Wapato
Water Tank
CAMPBELL
WAPATO ROAD
SLOUGH
29
28
32
33
34
5
4
3
8
9
10

## C. SUNNYSIDE DAM SITE

### Previous Investigations

The proposed Sunnyside Dam project area was surveyed in 1966 by David G. Rice. At that time he identified a series of housepit depressions "along an old high water bank of the Yakima River? The area of occupation is 60 x 20 m and is located between the Burlington Northern and Union Pacific railroad tracks. The archaeological site 45-YK-106 is situated just east of a gravel pit and in the immediate vicinity of the proposed project.

### History

The Sunnyside Dam is eligible for the National Register of Historic Places. The Determination of Eligibility is reproduced in its entirety to illustrate the significance of the historic site.

Determination of Eligibility

Sunnyside Diversion Dam and Canal Headworks are located in Yakima County 2 miles southeast of Parker, Washington, in Section 28, T. 12 N., R. 19 E., W.M. This diversion dam is one of five major diversion structures of the Yakima Project, one of the first Federal irrigation projects. Irrigation water is provided to 103,600 acres of land lying along the Yakima River between Parker and Benton City, Washington.

The dam and headworks were the first actual construction work on the Yakima Project by the Reclamation Service (now the Bureau of Reclamation) after the Government purchased the system from the Washington Irrigation Company. The structure is part of the Sunnyside Division, one of the seven operating units of the Yakima Project. The United States has fee title to the dam and headworks.

Construction of the dam and headworks - one of the principle units of the Yakima Project - began on October 4, 1906. The concrete dam was constructed at a point on the river where an outcrop of bedrock is close to the ground surface for nearly the full width of the stream, forming an excellent foundation. The dam built by the Reclamation Service replaced a series of steel hinged brackets fastened to a concrete foundation which were raised upright to increase effectiveness at diverting water.

The structure was built to typical standards of the period with consideration for the specific site conditions. The diversion dam is a fixed weir with an embankment wing. The weir is of the "ogee" type, 8 feet high and 20 feet wide, including the apron. Total length of the dam is 500 feet. A fish ladder was constructed on the left side adjacent to the gatehouse. The original headgates in the canal headworks were wooden tainter gates with steel shafts and cast iron shaft bearings. These gates operated between reinforced concrete bulkheads. The tainter gates have been replaced with cast iron gates. Construction history of the dam and headworks does not indicate any significant problems confronted the engineers other than rapid fluctuation of the river which resulted from heavy precipitation in the mountains. This merely required adjustments in the work and completion schedules. Construction was completed on October 15, 1907.

Since the original construction several changes have occurred. In 1921 a second fish ladder was added adjacent to the right abutment. This apparently did not resolve the fish passage problems so another ladder was added in the center of the dam in 1929. The fish ladder adjacent to the gatehouse was removed in 1961 and replaced with a sluiceway and radial gate. Concrete deterioration required rehabilitation of the center ladder and weir crest in 1975.

The importance of Sunnyside Diversion Dam and headworks is founded upon its function of diverting water to irrigate agricultural lands. Irrigation diversions at Sunnyside are utilized by seven irrigation districts - Sunnyside Valley, Granger, Outlook, Grandview, Prosser, Snipes Mountain, and Benton. Water is pumped to irrigate lands above the canal and land below the canal is irrigated by gravity.. The above irrigation districts operate and maintain the pumping plants, water check structures, wasteways, trash removal systems, lateral distribution systems, monitoring and control equipment all of which is required to ensure delivery of water.

Project development has provided the local economy with a sound base. Maintenance of these rural characteristics is addressed in both the Yakima and Benton County's Comprehensive Plans. The structure has an important association with its location.

Although the structure has been rehabilitated and minimally changed since construction, its general original appearance has not been changed. The structure does not have significant recognizable architectural feature or engineering qualities. The structure has continually been used to complete its authorized function of diverting irrigation water. (Keys 1984)

Conclusions and Recommendations

Personal communication with David G. Rice, Archaeologists, U.S. Army Corps of Engineers (COE), Seattle District revealed that the site had been revisited this spring during the course of an inspection trip related to COE projects in the Yakima Basin. The archaeological site was found to be intact. Western Heritage recommends that if the proposed project cannot be constructed in an area to avoid the site, that the site be excavated to mitigate the adverse effect on the cultural resources.

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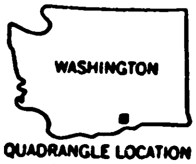
Figure 1. (D) The Prosser Site,
Section 36, T9N, R24E,
Prosser - Whitstran
Quadrangles, Wash.




QUADRANGLE LOCATION

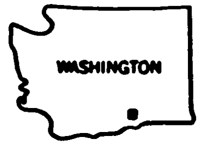
# PROSSER, WASH.

NE/4 PROSSER 15' QUADRANGLE

N4607.5—W11945/7.5

1965

AMS 2076 III NE—SERIES V891




QUADRANGLE LOCATION

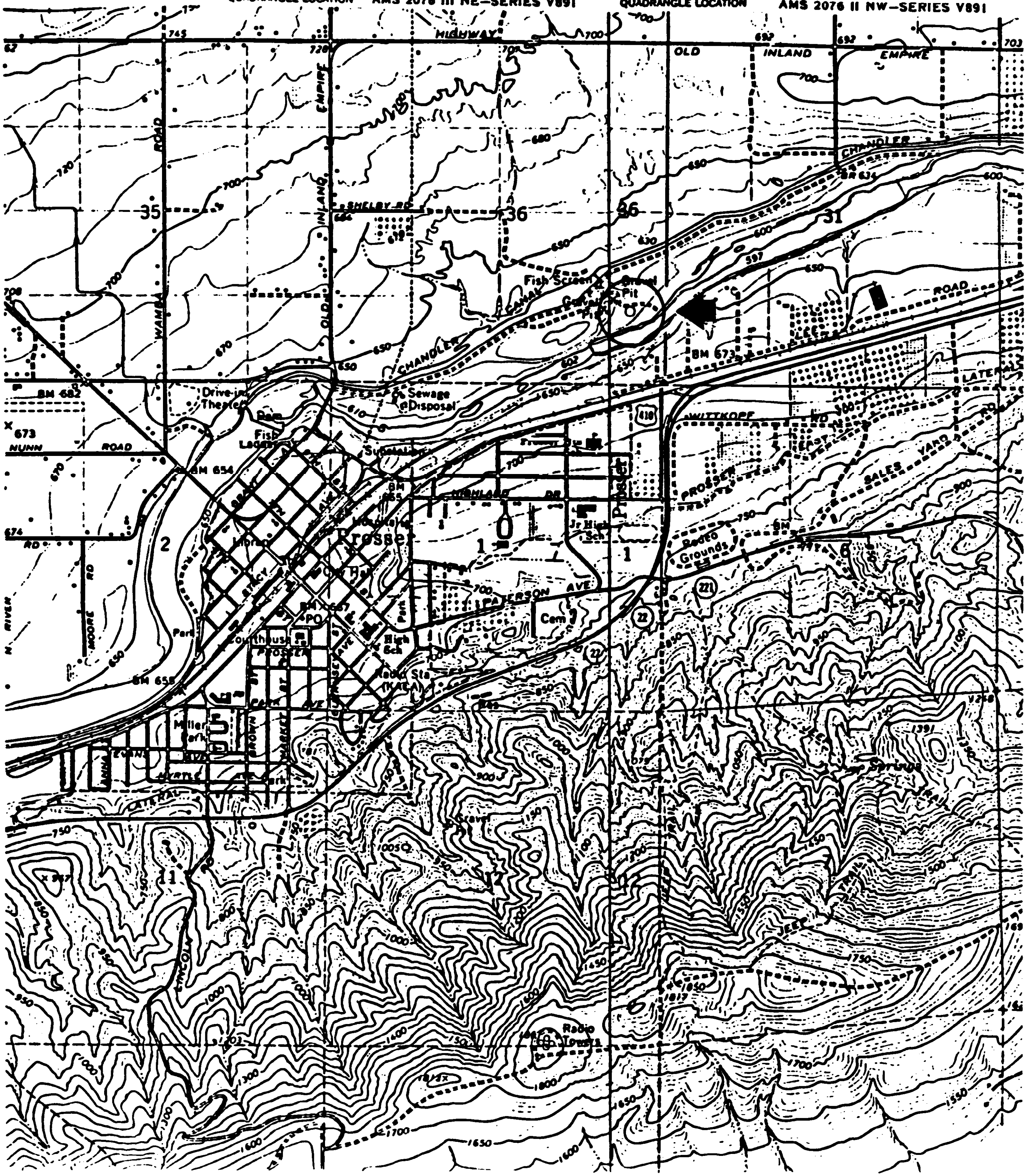
# WHITSTRAN, WASH.

NW/4 WHITSTRAN 15' QUADRANGLE

N4607.5—W11937.5/7.5

1965

AMS 2076 II NW—SERIES V891



D. PROSSER SITE

Previous Investigations

Archaeological studies in the Prosser area were undertaken first by Harlan I. Smith, for the U.S. National Museum in 1903 (Smith 1905) Smith concluded that the culture of the prehistoric people of the Yakima Valley and adjacent areas had strong similarities with the Thompson River area with evidence for more limited contact with the Plains and The Dalles on the lower Columbia, but almost no contact with the Washington coast. Smith stated that his studies seemed "to prove that the Yakima Valley was inhabited by people having a culture which previously had been unknown to science" (Smith 1910: 119).

Subsequent studies in the Yakima Valley have been related to federal highway projects and Bureau of Reclamation projects (Rice et al. 1981; Babcock 1986). One archaeological site, 45-BN-297, has been identified in the Prosser area in the vicinity of the Prosser Steel Bridge, however, the survey was related to a bridge replacement for the Department of Transportation.

History

Prosser, called Tap-tap by the Indians because of the falls on the Yakima River, was a major fishing village of the Yakima people. In historic times they continued to come to the area during the spring salmon run and established their fishing camp immediately north of Prosser Falls.

Among the first settlers was Colonel William Farrand Prosser. In 1882, he homesteaded acreage in the area and established a trading post which was called Yakima Falls. The county seat was established at Yakima Falls in 1893 and the name was change to Prosser Falls in honor of the colonel. By 1884, Nelson Rich and Jim Kinney had established general stores which stocked items to cater to farmer needs and the Northern Pacific constructed a depot on the line. In 1899, the name of the town which was shortened to Prosser and boasted a population of 229 residents when Prosser was incorporated. The town grew along with the development of agricultural pursuits and by 1899, the population reached 1,298. An editorial in the Republican-Bulletin published in 1913 summed up the phenomenal growth.

> A scarce thirty years ago, the Red Men and wild beasts roamed in undisputed possession of these valleys and foothills, yet a city has since arisen whose story of growth and development is a marvelous one. Here, magic like, [sic] is bounding into begin a city.

Conclusions and Recommendations

The Prosser Site has been variously disturbed by construction of the Chandler Canal and Interstate Highway 82, but given the history of the area as a prime fishing location for both Native Americans and pioneer settlers, Western Heritage recommends that a professional archaeologist monitor the Prosser Site during construction.

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1905 An Archaeological Expedition to the Columbia Valley. Records of the Past 4:119-27. Washington.

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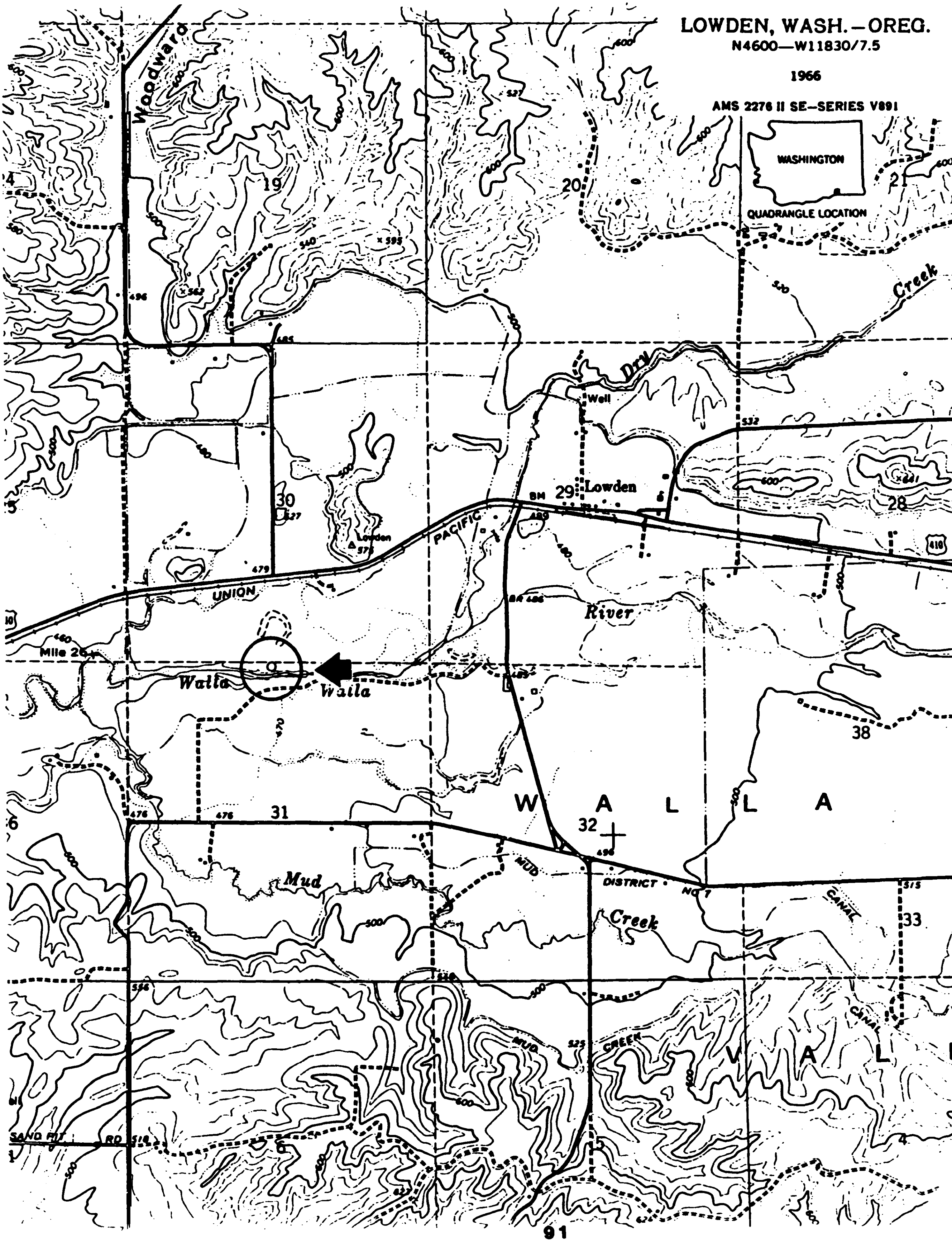
Figure 1. (E) The Walla Walla Site,
Section 30, T7N,, R34E,
Lowden Quadrangle, Wash.


LOWDEN, WASH.-OREG.
N4600—W11830/7.5
1966
AMS 2276 II SE-SERIES V891
WASHINGTON
QUADRANGLE LOCATION
Woodward
Creek
Dry
Well
Lowden
UNION
PACIFIC
River
Mile 26
Walla
Walla
W A L L A
Mud
MUD
DISTRICT
NO 7
CANAL
Creek
CREEK
SAND PIT
RD
91

E. WALLA WALLA SITE

Previous Investigations

No archaeological/historic studies have been made in the immediate area of the proposed Walla Walla Project. However, cultural resource investigations have been conducted at the confluence of the Walla Walla River with the Columbia River. Archaeological surveys were carried out by Smithsonian River Basin Survey (SRBS) teams in the late 1940s and early 1950s (Drucker 1947, l948b; Osborne and Shiner 1950, 1951). The surveys ident if ied five sites, 45-WW-5, 45-WW-5, 45-WW-6, 45-WW-35, and 45-WW-40 in the area. Excavations at the Wallula Site, 45-WW-6, were undertaken in 1951 and revealed a fishing village and associated burial areas (Shiner). The original site of Fort Walla Walla, a major crossroads and trading area on the Oregon Trail was located one-quarter of a mile to the north and was excavated in 1951 by Thomas R. Garth.

With the exception of 45-WV-34, The Walla Walla Dune Site, these sites are now inundated by the McNary Reservoir.

History

On April 27-28, 1806 on their return trip from the Pacific coast, Lewis and Clark camped on the Columbia near 15 mat lodges of the Chief of the Walla Walla, Yelleppit. At that time Yelleppit informed Lewis and Clark about an overland trail leaving the Columbia at the Walla Walla River in an easterly direction, skirting the northern foothills of the Blue Mountains, and reaching the Snake near its confluence with the Clearwater. Since the route was significantly shorter than following the shoreline of the Snake River, the commanders decided to take it. Known as the Nez Perce or "overland" trail, it was heavily utilized by the Indians and, in the following years, was traveled by many thousands of white frontiersmen

(Appleman 1975:164 map; Coues 1965, Vol. 3:978; and Thwaites 1959, Vol. 4:341). On the morning of April 29, 1806, the explorers transported their baggage to the south bank of the Columbia and proceeded one mile up the Walla Walla where they camped to round up their stray horses which had been brought over the day before. While spending the night there, the captains described in detail a large fish weir standing in the Walla Walla River. The next morning, April 30, 1806, the cavalcade set out for the distant Snake-Clearwater junction via the Touchet River. The Touchet River enters the Walla Walla approximately four miles downstream from the proposed project site.

The immediate project area was first settled by the Bergevin family. Louis Bergevin was a French-Canadian who came to the area in 1810 and engaged in pack-train activities carrying supplies to the gold mines in Montana. In 1865, his brother Damase Bergevin arrived from Quebec via St. Joseph, Missouri where he had been a logger. At first Damase stayed at French Town (Waiilatpu) some nine miles west of Walla Walla. However, in 1880 he formed a partnership with another brother Clement and they purchased farm land west of French Town. Damase eventually increased his holdings to some 1,600 acres of land along the present-day Highway 12. Bergevin married Mary Pamelia Allard in 1881 and they set up housekeeping in a two-room house on the land they had homesteaded in 1887.

Bergevin's grandson, Damase, lives in the same house where both his grandfather and father, Joseph Damase Bergevin, had lived. The house has

During a newspaper interview Damase stated that Indian relics were found by him and his wife Margaret no more than 100 feet from their house and that in the early days when his grandfather was away his grandmother hid herself and the children in the greasewood nearby when parties of Cayuse Indians were in the area. (Frenchman Farms Family Homestead, Walla Walla Union Bulletin, February 22, 1976).

Conclusions and Recommendations

The proposed construction site is located in an area known to have been heavily utilized by the Walla Walla and Cayuse people and, in particular, with their increased mobility due to the introduction of the horse in 1730. Even though the construction plans appear to be minimal, Western Heritage recommends that a reconnaissance survey be conducted.

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Thwaites, Reuben Gold (editor)

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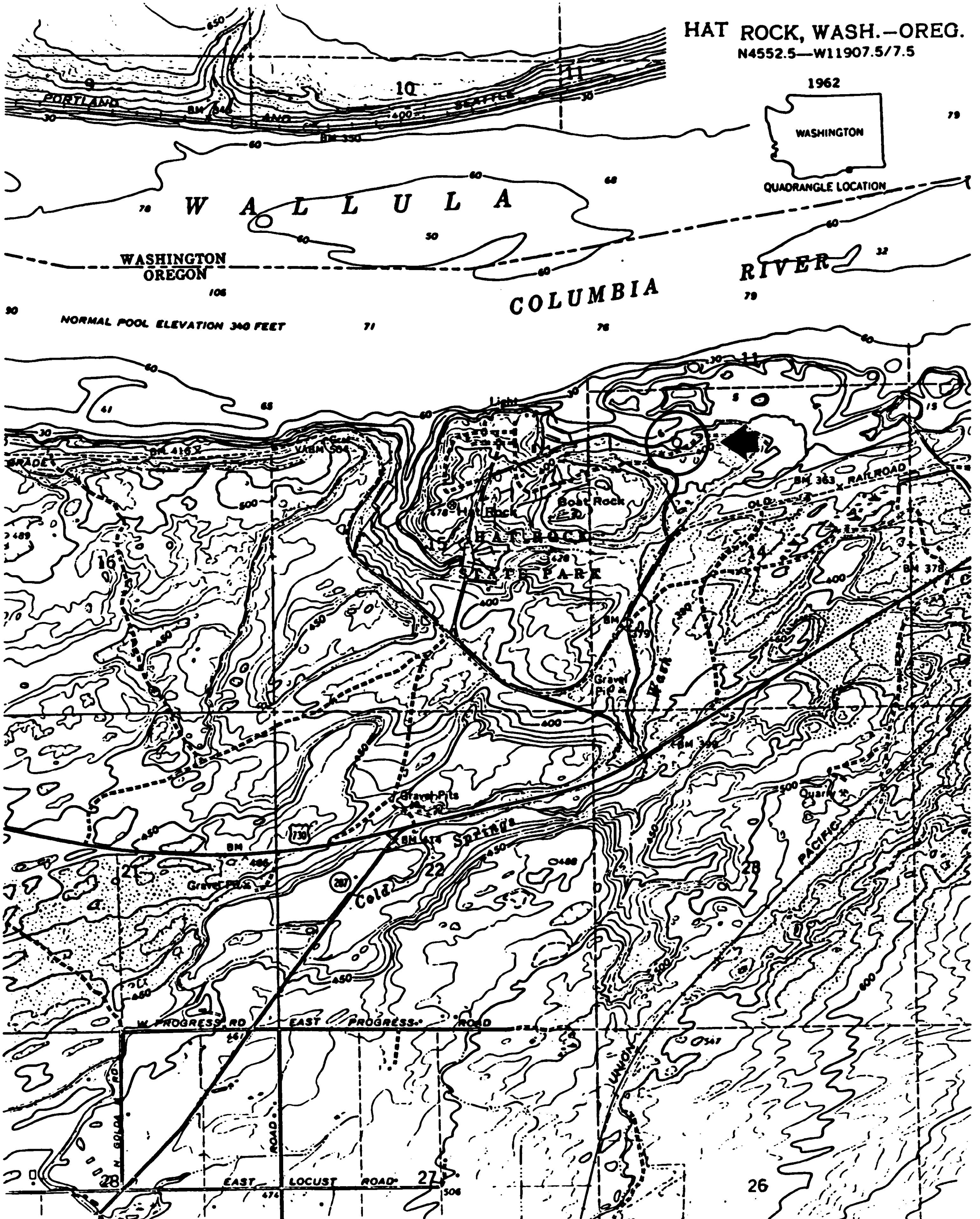
Figure 1.

Section 14, T5N, R29E,
Hat Rock Quadrangle, Wash.-Oreg.



HAT ROCK, WASH.-OREG.
N4552.5—W11907.5/7.5
1962
WASHINGTON
QUADRANGLE LOCATION
WALLULA
WASHINGTON
OREGON
COLUMBIA
RIVER
NORMAL POOL ELEVATION 340 FEET
PORTLAND
SEATTLE
Hat Rock
Boat Rock
HAT ROCK
STATE PARK
RAILROAD
Gravel Pit
Gravel Pits
Cold Springs
Quarry
PACIFIC
UNION
W PROGRESS RD
EAST PROGRESS ROAD
EAST LOCUST ROAD
N GOLDA RD
ROAD

## F. HAT ROCK POND SITE

### Previous Investigations

In 1947, Smith and Fenenga, archaeologists with the Smithsonian River Basin Survey (SRBS) team recorded three archaeological sites, 35-UM-5, 35-UM-6, and 35-UM-7 in the vicinity of the Hat Rock Pond project. 35-UM-5 occupies a high bench either side of the Hat Rock Creek drainage. Joel Shiner excavated the easternmost portion of 35-UM-5 in December of 1951 (Shiner 1951). In 1949 Douglas Osborne tested 35-UM-7, a village site containing housepits and a midden. A rockshelter, 35-UM-6, lies at the base of a lava escarpment east of Hat Rock butte. The shelter is inundated by waters of the McNary Reservoir.

### History

The Hat Rock area was first recorded in journals of Lewis and Clark. On October 18, 1805 the members of the Corps of Discovery had spent the night at Wallula Gap on the Columbia. Yelleppit, the "Great Chief" of the Walla Walla tribe and 20 men had come downriver from an island fishing village and camped nearby. On the following morning, October 13, 1805, the Indians parleyed with the whites by means of sign language and Yelleppit asked the white men to remain until noon so that his people could travel downstream to visit with them. The captains excused themselves, saying that they would stay with the Walla Walla for one or two days on the return journey. Winter was approaching, and the explorers had to be on their way. Launching their canoes, the party floated on down with the current.

After leaving Wallula Gap, on the south shore they saw a large rock "resembling a hat," which Clark named Hat Rock. Today the "chapeau" is included in Oregon's Hat Rock State Park. The central feature of the park is this basaltic monolith, which stands about fifty feet above the surrounding sagebrush plain. Hat Rock was the first landmark sighted and named by the Lewis and Clark expedition in what eventually became the State of Oregon (Stratton and Lindeman 1976:22-23; and Thwaites 1959, Vol. 3:132-135, and Vol. 8:map 3T, part 2).

Conclusions and Recommendations

The proposed Hat Rock Pond project area is located in an area known to have been heavily utilized by the prehistoric people. During the excavation of 35-UM-7, fire hearths were found 1.37 m below the surface of the test pits and the floor of the pithouses ranged to a depth of 51 cm. A lack of surface evidence does not preclude prehistoric occupation of an area. Western Heritage recommends that subsurface testing with a three inch auger be undertaken in the area prior to construction activities.

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1951 The Excavations at Site 35-UM-5 in the McNary Reservoir Oregon. Columbia Basin Project, River Basin Surveys, Smithsonian Institution, Eugene.

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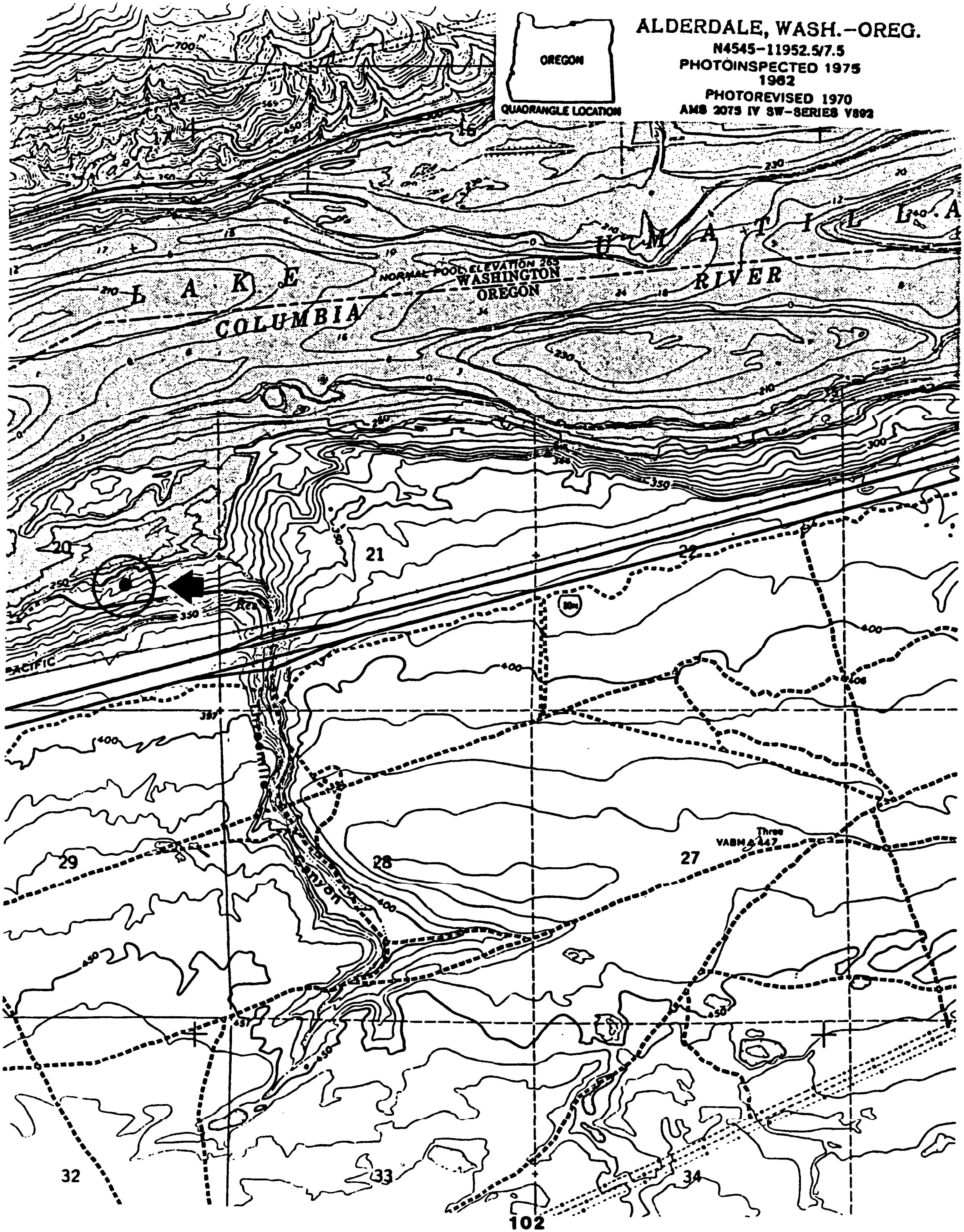
Thwaites, Reuben Gold (editor)
1959 Original Journals of the Lewis and Clark Expedition 1804-1806. Volumes 3 and 8. Antiquarian Press, New York.

Figure 1. (G) The Three Mile Canyon Site,
Section 20, T4N, 23E,
Alderdale Quadrangle, Wash.-Oreg.


ALDERDALE, WASH.-OREG.
N4545-11952.5/7.5
PHOTOINSPECTED 1975
1982
PHOTOREVISED 1970
AMS 2075 IV SW-SERIES V892
OREGON
QUADRANGLE LOCATION
LAKE UMATILLA
COLUMBIA RIVER
NORMAL POOL ELEVATION 265
WASHINGTON
OREGON
PACIFIC
Canyon
Three
VABM 447
20
21
22
29
28
27
32
33
34

## G. THREE MILE CANYON SITE

### Previous Investigations

On December 31, 1957, archaeologists Tom Newman and David Cole recorded two archaeological sites in the vicinity of the proposed Three Mile Canyon Pond Project. One site, 35-MW-4, is adjacent to the lower tip of Thanksgiving Island and lies between the railroad tracks and the river in a five foot deep, sand beach. Shell and worked stones were scattered on the surface and ran some one hundred and fifty yards along the tracks. An additional site, 35-MW-5, noted as in a good state of preservation, was found opposite the upper end of Thanksgiving Island in a substantial bank above the river. Some exposure in the bank showed shell, cores and other cultural debris (Cole and Newman 1958).

### History

The original town of Boardman was named for Samuel Boardman from Lowell, Massachusetts who homesteaded eighty acres on a flat stretch of sand along the Columbia River. Sam was a civil engineer who had worked for the railroads in the middle west and in Oregon before settling on the Columbia. Although by 1907 irrigation ditches of the Oregon Land and Water Company supplied water to Irrigon, west of Boardman it was not until 1917 that the ditch was extended to Boardman. However , Boardman, an energetic man, was not one to wait and planted trees fronting on the Columbia along his property. When the state constructed a highway through Boardman, Sam provided shade for travelers by landscaping mini-parks with trees. His efforts proved fruitful because he became the first Superintendent of Parks in the State of Oregon. When he retired, 151 parks encompassing some 61,500 acres provided respite for highway travelers and vacationers.

Conclusions and Recommendations

The two known archaeological sites bracket the proposed construction site at Three Mile Canyon. Western Heritage recomnends that a reconnaissance survey of the area should be conducted prior to construction activities.

## REFERENCES CITED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1958 Reappraisal of Archaeological Sites in the John Day Reservoir Area. Report to National Park Service, San Francisco. Museum of Natural History, University of Oregon, Eugene.

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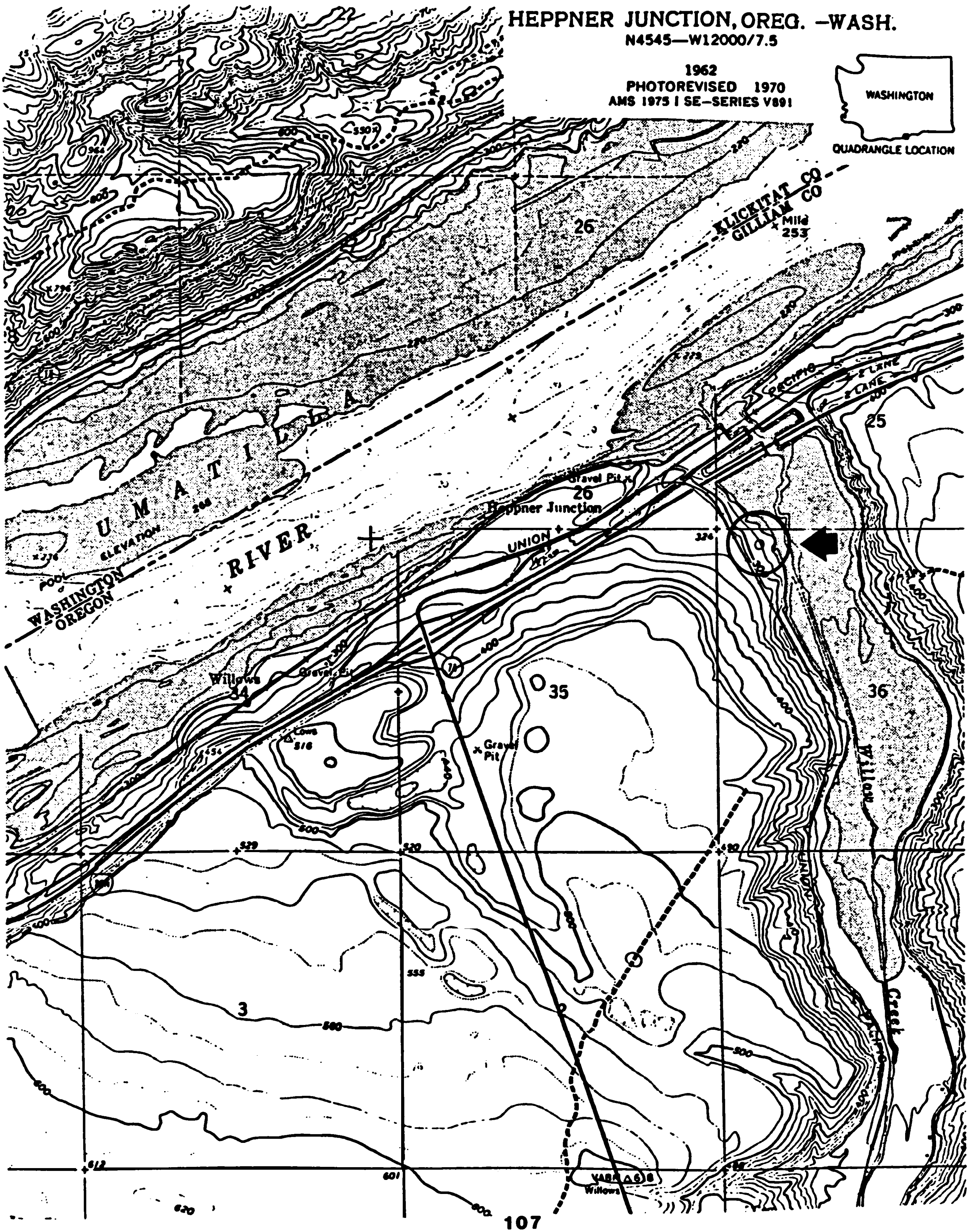
McArthur, Lewis A.

1982 Oregon Geographic Names. 5th edition. Western Imprints, The Press of Oregon Historical Society.

Figure 1. (H) The Willow Creek Backwater Site,
Section 36, T4N, R22E,
Heppner Junction Quadrangle, Oreg.-Wash.


HEPPNER JUNCTION, OREG. -WASH.
N4545—W12000/7.5
1962
PHOTOREVISED 1970
AMS 1975 I SE—SERIES V891
WASHINGTON
QUADRANGLE LOCATION
KLICKITAT CO
GILLIAM CO
U M A T I L L A
RIVER
ELEVATION 268
WASHINGTON
OREGON
Heppner Junction
Gravel Pit
UNION
PACIFIC
2 LANE
Willows
Gravel Pit
26
25
34
35
36
3
Willow
Creek

## H. WILLOW CREEK BACKWATER SITE

### Previous Investigations

Archaeological/historic studies in the Willow Creek drainage were carried out by Suphan (1965); Rice (1979); Lothson (1979); Cleveland and Schalk (1980) and Cleveland and Sutton (1980). Suphan (1974) and Cole's (1965) work was in relation to the proposed Willow Creek Dam. Rice made a reconnaissance survey of the Willow Creek Lake area while Lothson surveyed for the Willow Creek road relocation and investigated the Stanley Cox Water Tank Site. Cleveland and Schalk tested the Thompson Quarry Site near Heppner and Cleveland and Sutton's work concentrated on the Willow Creek Lake area.

Local residents have private collections of artifacts found in the Upper Balm Fork of the Willow Creek drainage and local informants remember that Native Americans followed the Balm Fork in the spring on their way to gather roots in the uplands.

However, intensive surveys together with subsurface testing which included backhoe trenches failed to disclose any prehistoric remains in the floodplains below Balm Fork. The Willow Creek drainage has been subject to catastrophic flooding in the past and this natural disturbance together with historic land leveling agricultural practices have obliterated any evidence of the prehistoric occupation.

### History

Although early settlers began farming the Willow Creek drainage in the late 1860s it was not until 1872 that the settlement was formalized when J.L. Morrow and Henry Heppner opened a mercantile store in Stansbury Flat. A year later the town boasted a blacksmith shop, a drugstore, a restaurant and a bar and was renamed Heppner in honor of Henry Heppner who led the drive for funds to establish a new school. By 1886, Heppner was the county seat for Morrow County and in addition to agricultural produce the area ranked second in the state in exporting wool.

In his report on the Willow Creek drainage, Sutton (1980) stated:

> The narrow valley in which Heppner is located appears to be an idyllic setting for a town, but four streams join within a mile of each other and since the 1903 flood, all of these creeks have inundated sections of the town. In 1934, Balm Fork and Willow Creek flooded the town and caused an estimated $100,000 damage (Heppner Gazette-Times, May 5, 1934). A 1943 cloudburst hit the city and caused some minor damage. An early spring freshet in 1949 flooded Willow Creek and Hinton Creek and did extensive damage to the county fairgrounds (Heppner Gazette-Times, March 3, 1949). Willow Creek overflowed its banks in 1957 and although Heppner was not damaged, many low-lying fields were destroyed (Heppner Gazette-Times, October 8, 1957).

More recently, Shobe Creek, approximately 1/4 mile downstream from the proposed Willow Creek Dam has been the culprit. On June 9, 1969 this stream overflowed its banks and caused extensive property damage.

## Conclusions and Recommendations

The proposed project site which is downstream near the mouth of the Willow Creek, has been subject to the scouring effect of floods over the years. There are no significant prehistoric or historic sites that would be subject to impact by the proposed construction. Western Heritage recommends that no further work with regard to archaeological/historical resources is necessary in the immediate project area.

## REFERENCES CITED


Cole, David

1965 Report on Archaeological Research in the John Day Dam Reservoir, 1964. Report to National Park Service, San Francisco. Museum of Natural History, University of Oregon, Eugene.

Cleveland, Gregory and Randall Schalk

1980 Archaeological testing of the Thompson Quarry Site, near Heppner, Oregon. Ms. on file, Washington Archaeological Research Center, Pullman.

Cleveland, Gregory C. and Robert K. Sutton

1980 Archaeological and Historical Surveys of Willow Creek Lake, Oregon. Report to U.S. Army Corps of Engineers, Walla Walla District, Walla Walla. Laboratory of Archaeology and History, Washington State University, Pullman.

Lothson, Gordon

1979 The Willow Creek Relocation Road and the Stanley Cox Water Tank Site. Ms. on file, Washington Archaeological Research Center, Pullman.

Rice, Harvey S.

1979 Preliminary Cultural Resource Reconnaissance of the Willow Creek Lake Project. Ms. on file, Washington Archaeological Research Center, Pullman.

Suphan, Robert J.

1965 Report on the Archaeological Surveys of the Proposed Sucker Creek, Applegate, Elk Creek, Lost Creek, and Willow Creek Dams. Report submitted to the National Park Service. University of Oregon, Eugene.

1974 Ethnological report on the Umatilla, Walla, and Cayuse Indians. In Oregon Indians II. Garland Publishing, Inc., New York.

## APPENDIX B

## GROUND WATER REPORT SUMMARY

| Site | Recommendation |
|---|---|
| Sunnyside | Not Required |
| Prosser | Not Required |
| White Bluffs | 1 - 200 foot deep well, 2 cfs |
| Hat Rock | 1 - 150 foot deep well, 2 cfs |
| Ringold | Not Required |
| Willow Creek | 1 - 1,000 foot deep well, 2 cfs |
| Three Mile Canyon | 1 - 1,000 foot deep well, 2 cfs |
| Walla Walla | 1 - 500 foot deep well, 2 cfs |

## APPENDIX C

## BIBLIOGRAPHY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Wheaton, Fredrick W., 1977, Agricultural Engineering, John Wiley & Sons, New York, NY

APPENDIX D

FISH HEALTH REPORT

UNITED STATES GOVERNMENT FISH AND WILDLIFE SERVICE

# *Memorandum*

TO : Regional Director, AFR, Divison 3 Manager DATE: 8/19/87

FROM : Area Biologist
Lower Columbia River Fish Health Center

SUBJECT: Upriver Sites for Rearing Fall Chinook Salmon

The first proposed site visited was the Prosser Juvenille Trap located north of Prosser, WA on the north side of the Yakima River. Water for rearing and holding adults would come from the large Chandler irrigation canal located north of the site (see attached photo).

Fish being held at this site would be subjected to all pathogens that are present in the Yakima River. This includes known bacterial pathogens such as Aeromonas salmonicida, Yersinia ruckeri, Flexibacter columnaris, Cytophaga psychrophila, and Renibacterium salmoninarum. All of the common fish parasites are present in the Yakima River. There are no known viral pathogens in the Yakima River at the present time. (There has been limited sampling efforts for viruses in the Yakima River). Major pathogens of concern for this site are as follows:

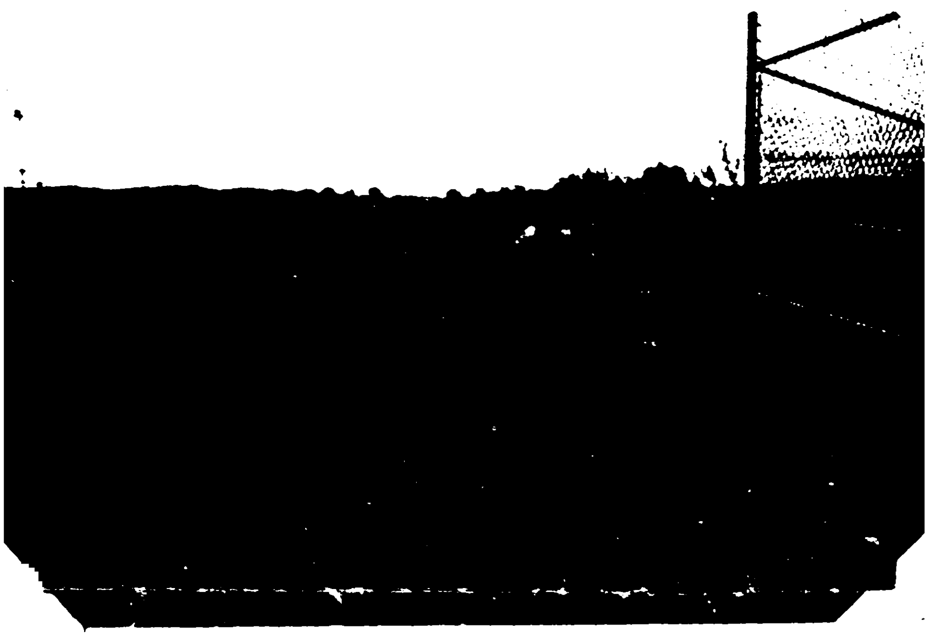
Aeromonas salmonicida, Cytophaga psychrophila, Ichthyophthirius, Costia, Trichodina, trichophrya, infectious hematopoietic necrosis. Ceratomyxa shasta and Myxobolus cerebralis would be a major concern if they ever became established in the Yakima River.

I would not recommend this location for upriver bright fall chinook salmon rearing and adult holding.

The second proposed site visited was the Sunnyside Dam located north of Wapato, WA and west of the Sunnyside Dam. Water for rearing and holding adults would come from impounded Yakima River and be pumped to ponds. (See attached photo).

Fish being reared or held at this site would be subjected to the same pathogens as for the Prosser site.

I would not recommend this location for upriver bright fall chinook salmon rearing and adult holding.



The third proposed site visited was at White Bluffs located southeast of Vantage, WA on the east side of the Columbia River. (See photos).

The water source for this site will be slack water in the Columbia River for net pens or irrigation water for raceways. Both water sources pose a threat. The Columbia River is a potential source of many different fish pathogens. IHN and IPN have been isolated upriver from this site. The other pathogens of concern are the same as mentioned in the Yakima River. The irrigation source water may or may not contain fish pathogens. It is assumed there would be some present in this water. The main concern is organic pollutants that could disrupt the metabolism of the fish. Insecticides, pesticides and various fertilizers may negate using the water for rearing.

This site is not desirable for fish rearing and adult holding.

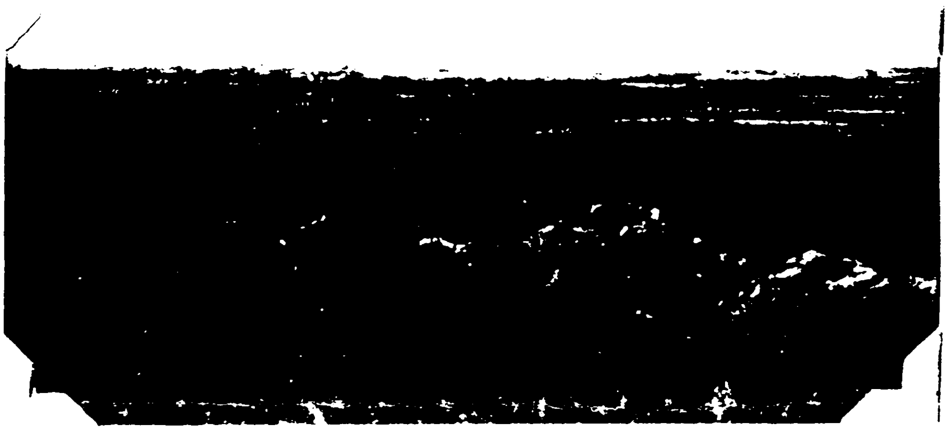
The fourth site visited was Ringold Pond located on the east side of the Columbia River at Ringold, WA. (See photos).

The water source for this site is spring water. Raceways and a pond would be developed at this site. The 9 acre pond already exists as well as adult trapping facilities. This is an ideal water source for rearing and adult holding. There are only minor fish pathogens present at this site. There would be essentially no threat from major fish pathogens from this water supply.

It would be my recommendation to use this site for rearing and adult holding which would provide the best quality fish possible.

The alternate site at Ringold springs would not be as desirable because runoff irrigation water is proposed for rearing and adult holding. There is probably no threat from major disease organisms, but contaminants from farm use may be a serious problem.

I would recommend this site if the first location is not feasible.



The fifth site visited was at Walla Walla located one mile west of Lowden, WA. (See photo).

The water source for ths site is from ground water. In my opinion there is not enough water and the exchange rate for the channel would be much too slow. Lengthening the channel would compound problems by placing additonal stress on fish. Numerous disease problems would arise because of these stresses. Epizootics could be caused from minor pathogens, i.e. (Ich and other external parasites, Aeromonas liquifaciens, pseudomonas fluorscens).

I would definately not recommend this site.

The sixth site visited was at Hatrock Ponds located at Hatrock State Park, OR. (See photo).

The water source for this site is Columbia River slack water, ground water or springs. Potential major pathogens have been mentioned for Columbia River water. The ground water would be pathogen free. The spring water would be free from pathogens. If the rainbow trout catch-out program would be continued there could be an impact on later salmon rearing in the same pond. This would necessitate more studying to determine the potential hazards. Certification would need to be performed on all stocks of fish.

I would recommend this site only if Ringold Springs or the alternate at Ringold Springs were not used.

The seventh site visited was at Three Mile Canyon located about 15 miles west of Boardman, OR. (See photo).

The water source for this site is Columbia River slack water. Disease implications associated with using Columbia River water have been mentioned previously. At this location there is also the possibility of Ceratomyxa shasta infections.

I would not recommend this site for rearing or adult holding.

The eigth site visited was at Willow Creek located about 9 miles east of Arlington, OR. (See photo).

The water source for the site would be Columbia River and ground water. Diseases have been previously mentioned for Columbia River water.

I would not recommend this site for rearing and adult holding.

If you have any questions regarding any of these sites, please call me.

Steve

# JOHN DAY FALL CHINOOK/SALMON MITIGATION PLAN
# ACCLIMATION AND IMPRINTING
# SITE FEASIBILITY STUDY
# SUNNYSIDE DAM SITE

Completion Report

by

U.S. FISH AND WILDLIFE SERVICE
Portland, Oregon

and

SVERDRUP CORPORATION
Bellevue, Washington

Funded by

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
DIVISION OF FISH AND WILDLIFE
CONTRACT NO. 14-16-0001-84078
PROJECT NO.________

September 1987

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## APPENDICES

# I INTRODUCTION

Sunnyside Dam is one of 10 locations being considered for an acclimation facility as part of the John Day Fall Chinook Mitigation Plan. This report presents results from an engineering study of the Sunnyside Dam site.

# II SITE INFORMATION

## A. Location

Sunnyside Dam is located on the Yakima River at river mile 103.8. The proposed acclimation site is near the west abutment of the dam and within the boundaries of the Yakima Indian Reservation. The site is in Section 28, Township 12 North, Range 19 East, approximately 7.5 miles south of Yakima and 2 miles southeast of Parker, Washington. Figure 1 is a Location Map and Figure 2 is a Vicinity Map for the Sunnyside site.

## B. Land Ownership

The United States Government has fee title to the dam and headworks. However, there are several private tracts of land that could be impacted by construction of the acclimation facilities. One of the tracts has 60 to 70 owners and some parcels are being leased to other individuals.

## C. Site Description

Sunnyside Dam and Canal Headworks is one of the first federal irrigation projects and is eligible for the National Register of Historic Places. The project provides irrigation water to 103,600 acres of land adjacent to the Yakima River between Parker and

Benton City, Washington. The headworks and fish ladders at Sunnyside Dam were recently reconstructed and the dam crest raised 0.3 of a foot.

The acclimation facilities would be located between the west end of the dam and the railroad tracks and downstream from an earth dike that is an extension of Sunnyside Dam. The earth dike is approximately 8 feet high and will divert river flood waters away from the acclimation site and over the dam. The site is generally level, with sparse vegetation.

D. <u>Access and Services</u>

Access to the site is good. There are asphalt paved roads to within 0.8 miles. A gravel road exits the paved road on the left, just west of Parker Bridge, and follows the west bank of the river to the site.

E. <u>Soils and Vegetation</u>

Soils in the project area generally appear to be permeable alluvial deposits of sand and gravel. There is no surficial evidence of bedrock in the acclimation pond site area. However, the dam site was selected because shallow bedrock was present for the full width of the stream. The soils at the site are expected to be suitable for supporting the required structures.

## F. Flood Levels

Generally, the most severe flooding from the Yakima River occurs during the months of April, May and June. Spring rains and snow melt contribute to this annual flood schedule.

Flood data for the Yakima River were extracted from the "Flood Insurance Study" by the Federal Emergency Management Agency for Yakima County, Volume 1 of 2. Other data were taken from "Streamflow Statistics and Drainage - Basin Characteristics for the Southwestern and Eastern Regions, Washington", Volume 2, prepared by the U.S. Geological Survey (USGS). Using the USGS data and the Standard Log - Pearson Type III Method, 10-, 50- and 100-year flood levels were calculated, as follows:

| Recurrences Intervals | Flood Discharge | Flood Elevation Project Site |
|---|---|---|
| 10 Years | 26,000 cfs | |
| 50 Years | 43,500 cfs | 904.5 |
| 100 Years | 55,000 cfs | 907.0 |

Flood elevations shown on the plans and referred to in the text were computed using the above data, Manning's Formula, the equation for flow over an ogee spillway and information obtained during field reconnaissance of the proposed site. The referenced flood data is in Appendix B.

G. Utilities

Sunnyside Dam site is in the service areas of Pacific Power are Light, Yakima, Washington and United Telephone Company, Hood River Oregon. There is existing single phase electrical power to the site, but no telephone service. Three phase electrical service for large pump motors would have to be extended to the site. Both utilities have been contacted and asked to provide cost estimates for services at the site. Refer to the cost summaries in Section VI and to correspondence in Appendix A.

H. Cultural Resources

Significant cultural resources are located in close proximity to the proposed project. If the project cannot be constructsa to avoid impacting the cultural resources, then the site will have to be excavated to mitigate impacts on these resources.

# III PRODUCTION GOALS

Initial studies of the sites along the Yakima River were based on their use for acclimation of l,OOO,OOO (11,000 pounds at 90 per pound) bright fall chinook at the facility. The fish would be trucked to the site and the acclimation period would be from the end of April to the end of May each year. Two to three groups of fish would arrive at the site and be held for one to two weeks before release to the river. With this use for the facility, initial site planning was based on use of a standard half-acre rearing pond with a water supply of approximately 10 cubic feet per second (cfs).

Review of the draft Yakima Central Outplanting Facility Master Plan Studies indicated that the Sunnyside Dam site was planned for use in evaluation of acclimation times, release, location and time of release. Five experimental lots of 200,000 fall chinook were tentatively planned to be held and released at the Sunnyside Dam site.

Since the purpose of this study is to evaluate and compare alternative sites for acclimation, it was important to compare all sites on an equal basis. Therefore, the Sunnyside Dam site was evaluated on the same basis for production as other sites with adequate water supplies. This production criterion is the capability to provide acclimation for 30,000 pounds of fry or smolts in four 7,500-pound lots.

## IV DEVELOPMENT CONCEPTS

Fry and smolt rearing is accomplished by containing the fish in a manageable enclosure; providing them with a constant supply of water with certain temperature, quality and flow rate parameters; and feeding them scientifically formulated commercially available food. At Sunnyside Dam, only land based alternatives were analyzed.

Discussions of specific concepts follow:

### A. Water Supply

On the west bank of the River at Sunnyside Dam there is a fish ladder that was recently reconstructed. The rearing pond site proposed is located to the west of the ladder. From reconnaissance and study of construction drawings it was determined that this structure could be used as the intake for acclimation pond supply water. At the north end of the ladder is an 8-foot by 5-foot water intake chamber that is at elevation 903 at the top and 890 at the bottom. The purpose of the chamber is to provide supplemental attraction water to the ladder entrance. Water will be withdrawn from this chamber at an elevation below the dam crest (899.3 feet). Water will then be routed through a pipe to a pumping station/fish screen structure at a remote site downstream of the earth dike (see Figures 3 and 5). Water to the ponds will then be pumped out of the structure. Excess bypass water and screened fish will routed back to the river below the dam forebay. Pumping water from this remote station is required to avoid disruption of adult fish migration, due to noise and vibration, through the fish ladder.

Since the Sunnyside site is adjacent to a dam, first appearances are that water supply to rearing ponds could be provided by means of gravity flow. Through hydraulic calculations, it has been determined that a gravity flow system would require 7 to 8 feet of head to work properly. During certain river flows 7 to 8 feet of head is not always available for use.

Dam operators attempt to keep the forebay elevation at 899.36 feet, but with the cyclical effect of irrigation demand upstream it can drop below this. It is normally easy to maintain this elevation during May because May is the "high flow" month of the year. However, even in May, periods of low flow occur, lowering the forebay elevation. The U.S. Bureau of Reclamation is tentatively committed to divert 200 cfs down the Yakima River at Sunnyside Dam, with the rest going down Sunnyside Canal (normally near 1,200 cfs). With this effect of flow in the river, sometimes less than 200 cfs is maintained, and flows down the Yakima have been reduced to as low as 68 cfs during the month of May. These flow forecast problems make establishing a gravity pond elevation virtually impossible. For this reason, and others mentioned in "Site Selection", we feel a gravity fed pond would not be feasible.

## B. Site Selection

At the Sunnyside site a relatively large level area exists just off the west end of the dam. Operators of the dam facility report that during flooding, an eddy forms just downstream of the west bank fish ladder and large amounts of ice and debris are deposited in the level area proposed for the acclimation facilities. The site is at elevation 903 and, as stated, the 100 year flood level is at elevation 907. Therefore, to provide protection it will be necessary to raise the site four or five feet. This is a small cost item and it is included in the construction cost summary.

## C. Raceways, Ponds and Adult Capture

These concepts have either eight - 10 by 100 by 3.5 foot deep concrete raceways, four - 40 by 80 by 4 foot deep asphalt ponds or eighteen - 8 by 80 by 2.5 foot deep temporary vinyl raceways. The asphalt ponds can be constructed with PVC liner instead of the asphalt to compare alternative costs. (All of these rearing enclosures are discussed more extensively in the Acclimation Project Summary Report.) A standard flow of 15 cfs is used to supply each concept. By doing this, varieties of ponds can be more easily compared quantitatively. The station manager's office/residence, the fish food freezer/preparation building and security fencing are also part of these land based concepts. Site plans for both concrete raceways and asphalt-lined ponds are shown in Figures 3 and 4, respectively.

Adult capture facilities have not been addressed on Yakima River acclimation pond sites. There are existing fish passage structures on the river that can be modified to trap returning adult salmon more cost effectively than by incorporating adult capture into the acclimation facility. With adult capture facilities removed from this concept, costs are greatly reduced.

D. Fish Screen/Pump Structure

The fish screen/pump structure is located to keep noisy pumps away from the fish ladder. More specific details are described below.

A 24-inch ductile iron pipe will route 20 cfs from the dam forebay. Some fish will be drawn out of the forebay with this flow and fish will be screened out while traveling through the screen structure. A total of 15 cfs will be pumped out of the pump station and directed to the ponds or raceways. The remaining 5 cfs and returned fish will flow by gravity back to the river through a 14-inch ductile iron pipe. The outlet will exit downstream of the dam.

A schematic of the fish screen/pump structure is provided in Figure 5. The top of the structure is set at elevation 903, which is level with the top of the existing fish ladder. The bottom can be set at an elevation that will ensure flow in and out of the pump structure. Pump motors will then be installed on top of the structure at an elevation above the 100-year flood elevation (905 feet).

# V WATER QUALITY AND TEMPERATURE

On May 19, 1987, water samples were collected from the Yakima River at Sunnyside Dam. These were taken to AM Test, Inc. in Redmond, Washington for analysis. Results are provided in Appendix C.

The river water samples had concentrations of ammonia and zinc in excess of the maximum desired level listed in the U.S. Fish & Wildlife proposal to the Bonneville Power Administration. The water temperature on May 19, 1987 was 51 degrees F at 10:30 a.m.

## VI COST SUMMARY

A construction cost summary, exclusive of land acquisition or professional services fees for the raceways and ponds alternatives, is shown in Table 1.

- TABLE 1 -

SUNNYSIDE DAM COST SUMMARY

| | Concrete Raceways | Asphalt Ponds | Membrane Ponds | Vinyl Raceways |
|---|---|---|---|---|
| Site Preparation | $ 57,600 | $ 75,400 | $ 75,400 | $ 57,600 |
| Ponds, Raceways, or Net Pens | 247,000 | 93,200 | 79,700 | 205,700 |
| River Water Pump Station | 125,800 | 125,800 | 125,800 | 125,800 |
| Office/Housing | 12,500 | 12,500 | 12,500 | 12,500 |
| Food Freezer/Prep. Bldg.* | 48,900 | 48,900 | 48,900 | 48,900 |
| Standby Generator | 27,900 | 27,900 | 27,900 | 27,900 |
| Motor Starters/Switch Gear | 9,200 | 9,200 | 9,200 | 9,200 |
| Electric Utility (New 30) | 5,000 | 5,000 | 5,000 | 5,000 |
| Telephone Utility | 300 | 300 | 300 | 300 |
| Subtotal | 534,200 | 398,200 | 384,700 | 492,900 |
| 15% Contingency | 80,100 | 59,700 | 57,700 | 73,900 |
| Total | $614,300 | $457,900 | $442,400 | $566,800 |
| Monthly Power Cost | 1,678 | 1,678 | 1,678 | 1,678 |

* Portable Freezer Van Alternative Cost = $41.500

## VII ADVANTAGES AND DISADVANTAGES

The Sunnyside Dam site has the following advantages and disadvantages:

All water must be pumped.

Existing improvements made the pump station construction cost less than other sites.

- Adult capture, holding, and spawning must be done at an off-site location. An existing upstream fish ladder could potentially be modified for this purpose.
- There are several private land owners who must either sell property or grant use easements.

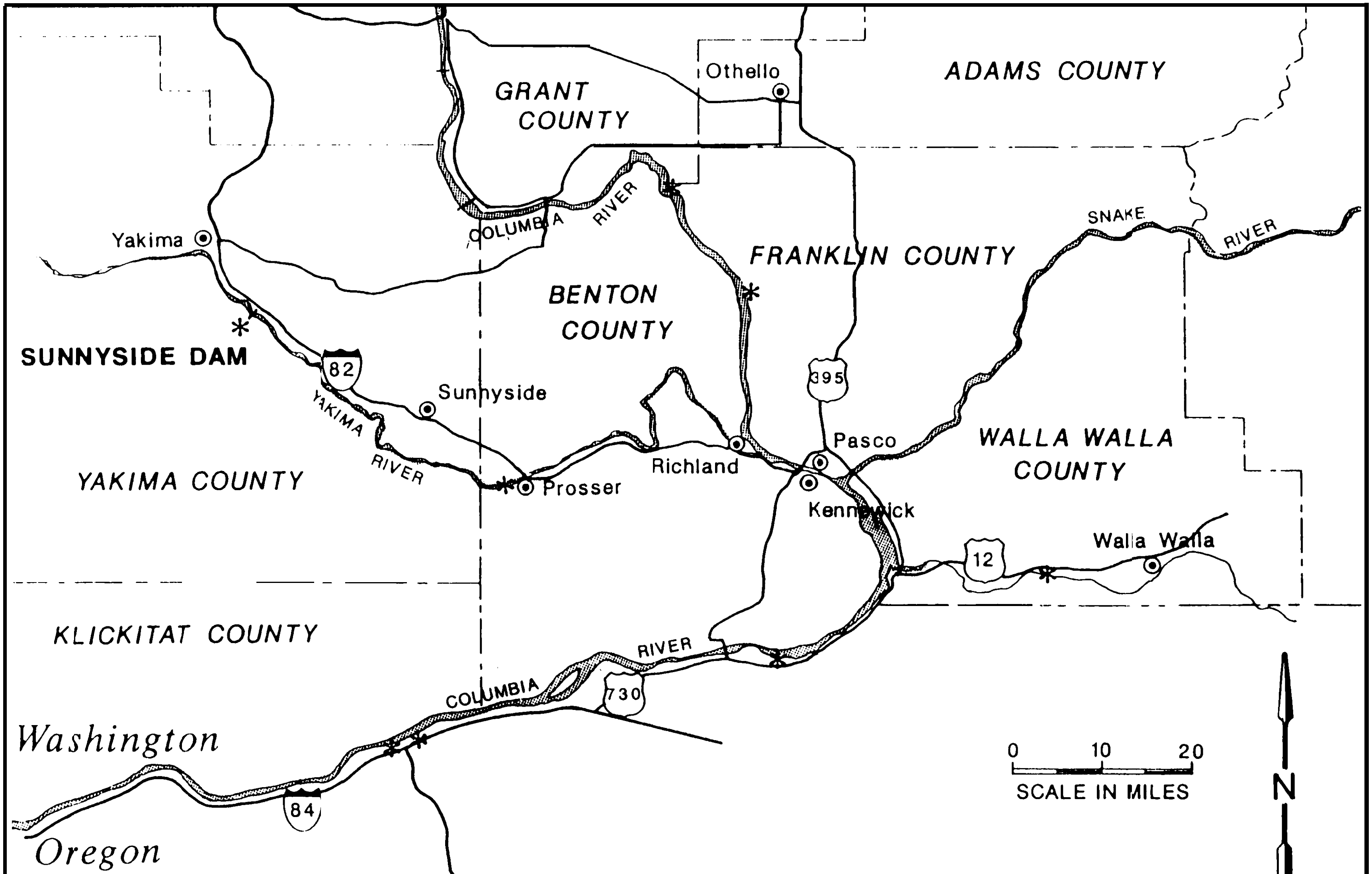
River sediment potentially could plug the pump's intake, resulting in an increased maintenance burden.

Pumped Yakima River water may not be sufficiently unique for imprinting to this site.

- There are potential fish health problems.

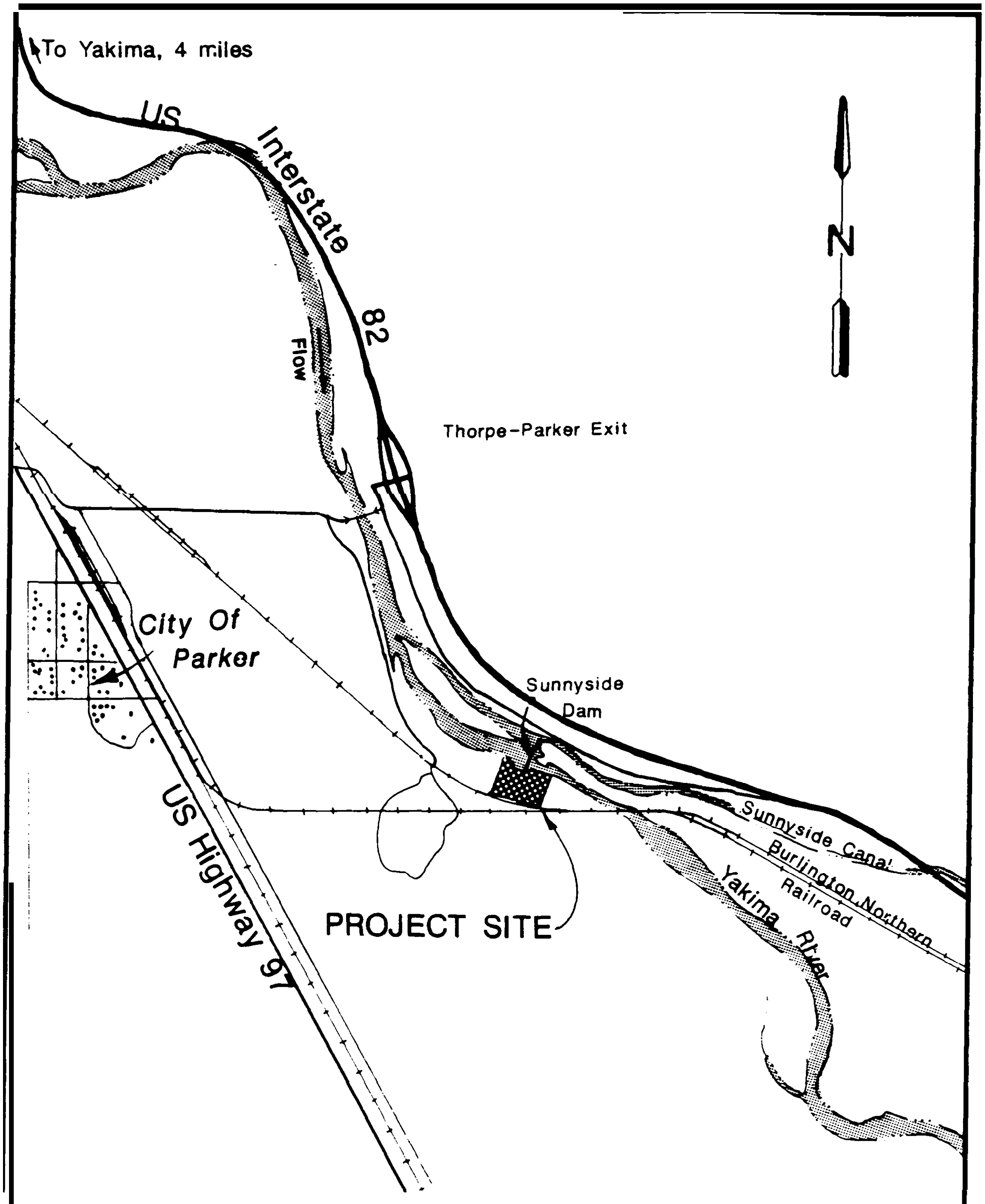
The site is generally good for access and the availability of utilities.

- River water has excess concentrations of ammonia and zinc.




**LOCATION MAP**

FIGURE 1

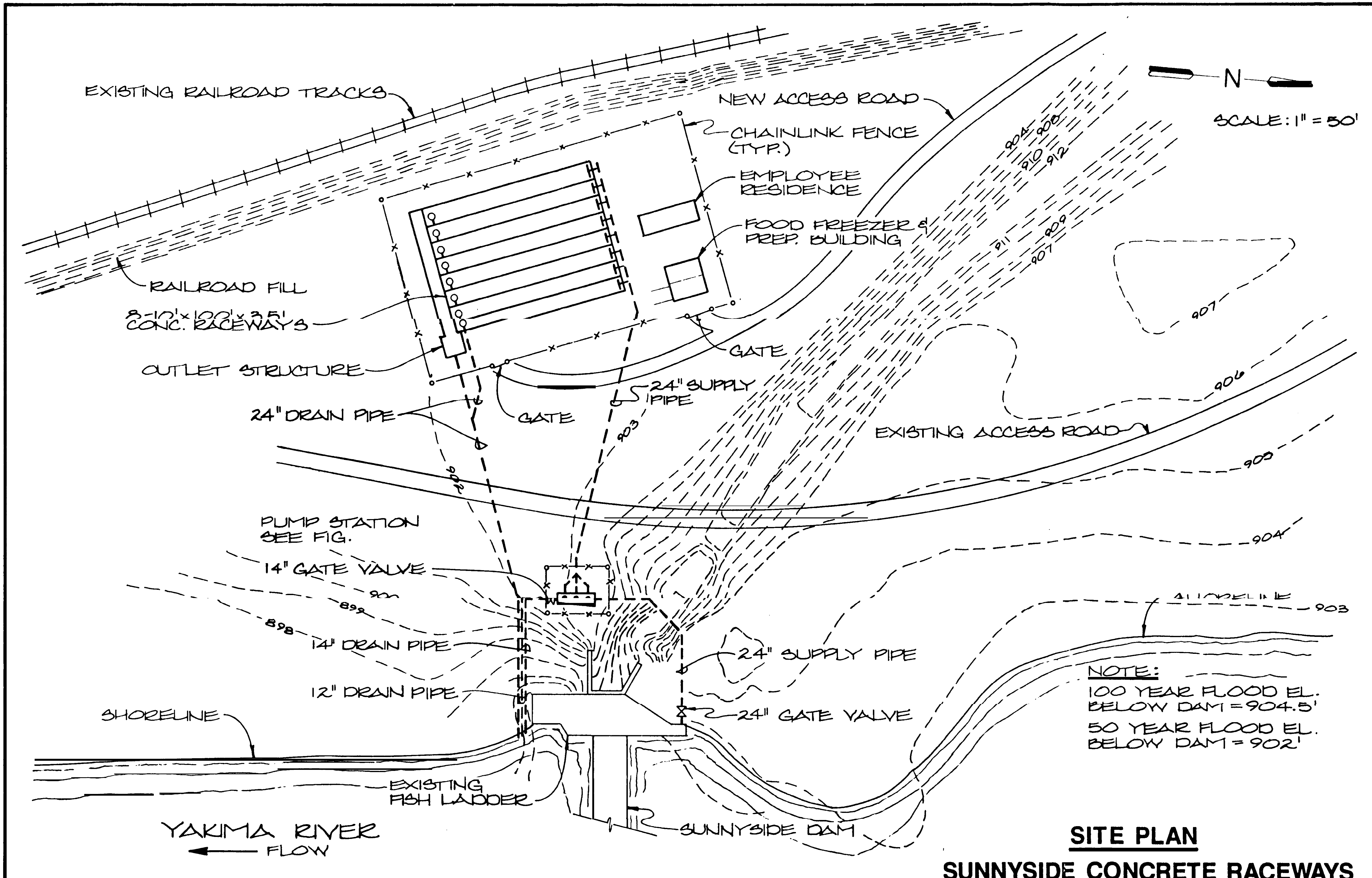



**VICINITY MAP**

**SUNNYSIDE DAM**

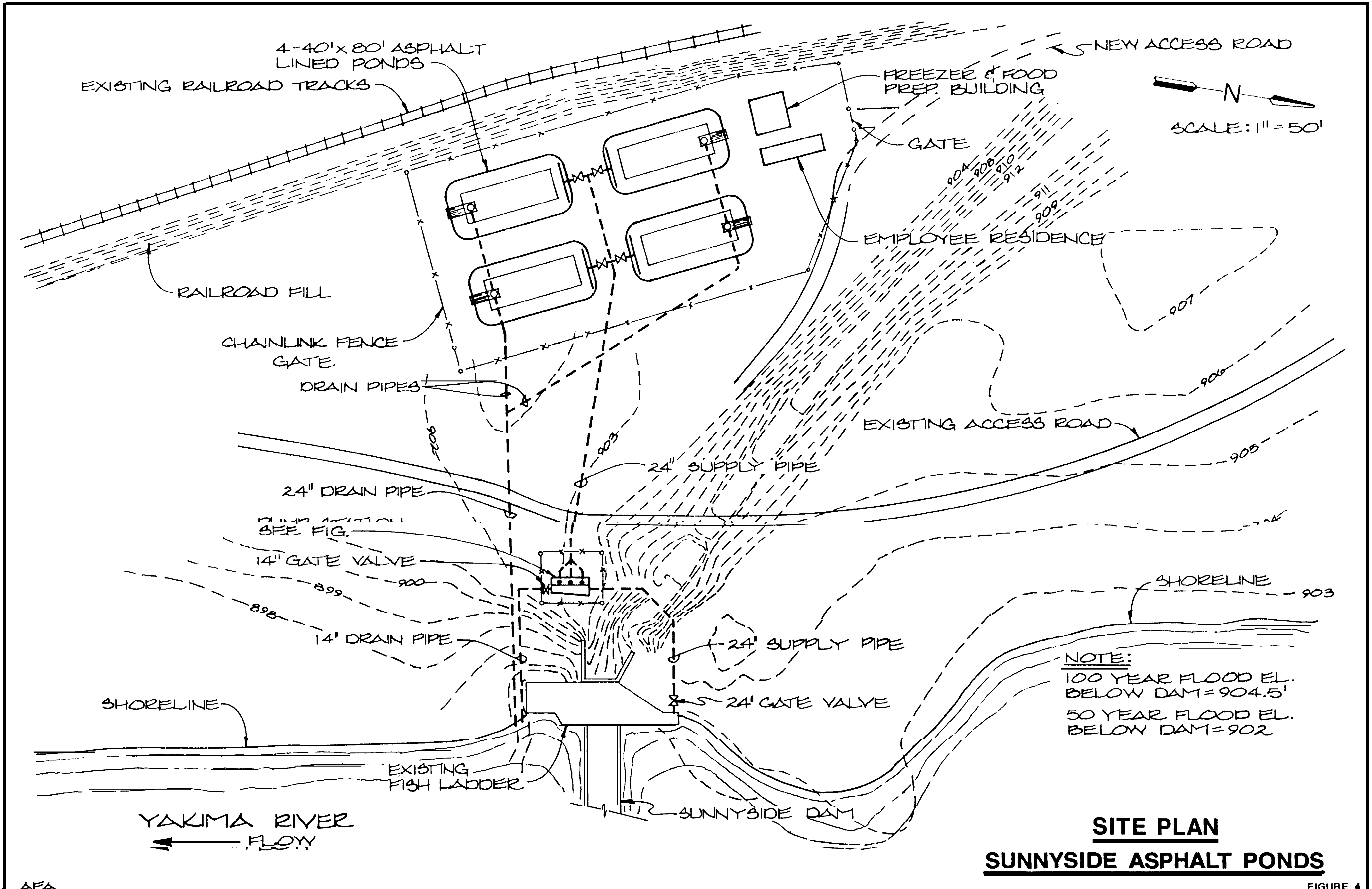
SCALE: 1"=2000'

FIGURE 2




**SITE PLAN**
**SUNNYSIDE CONCRETE RACEWAYS**

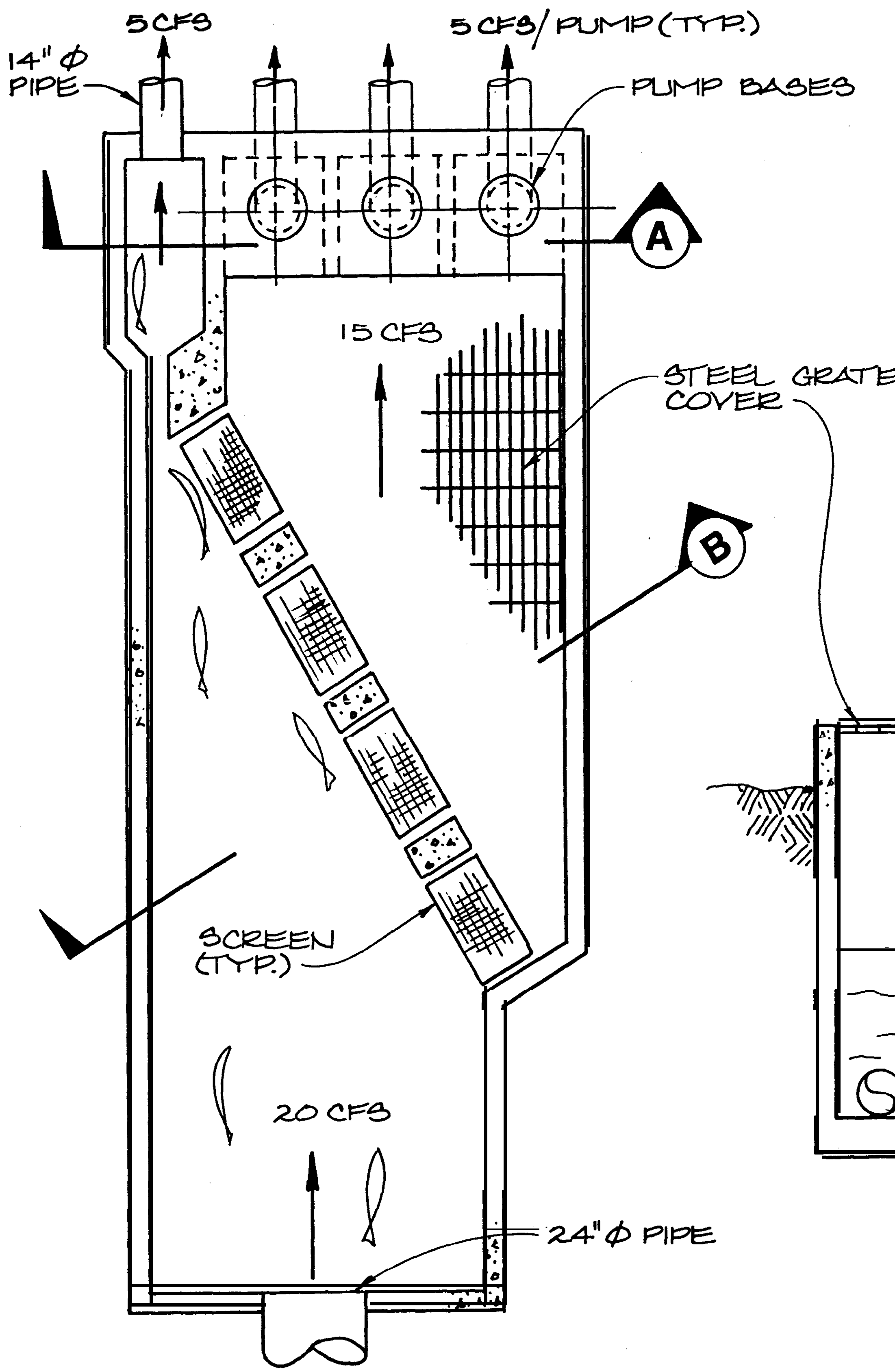
FIGURE 3



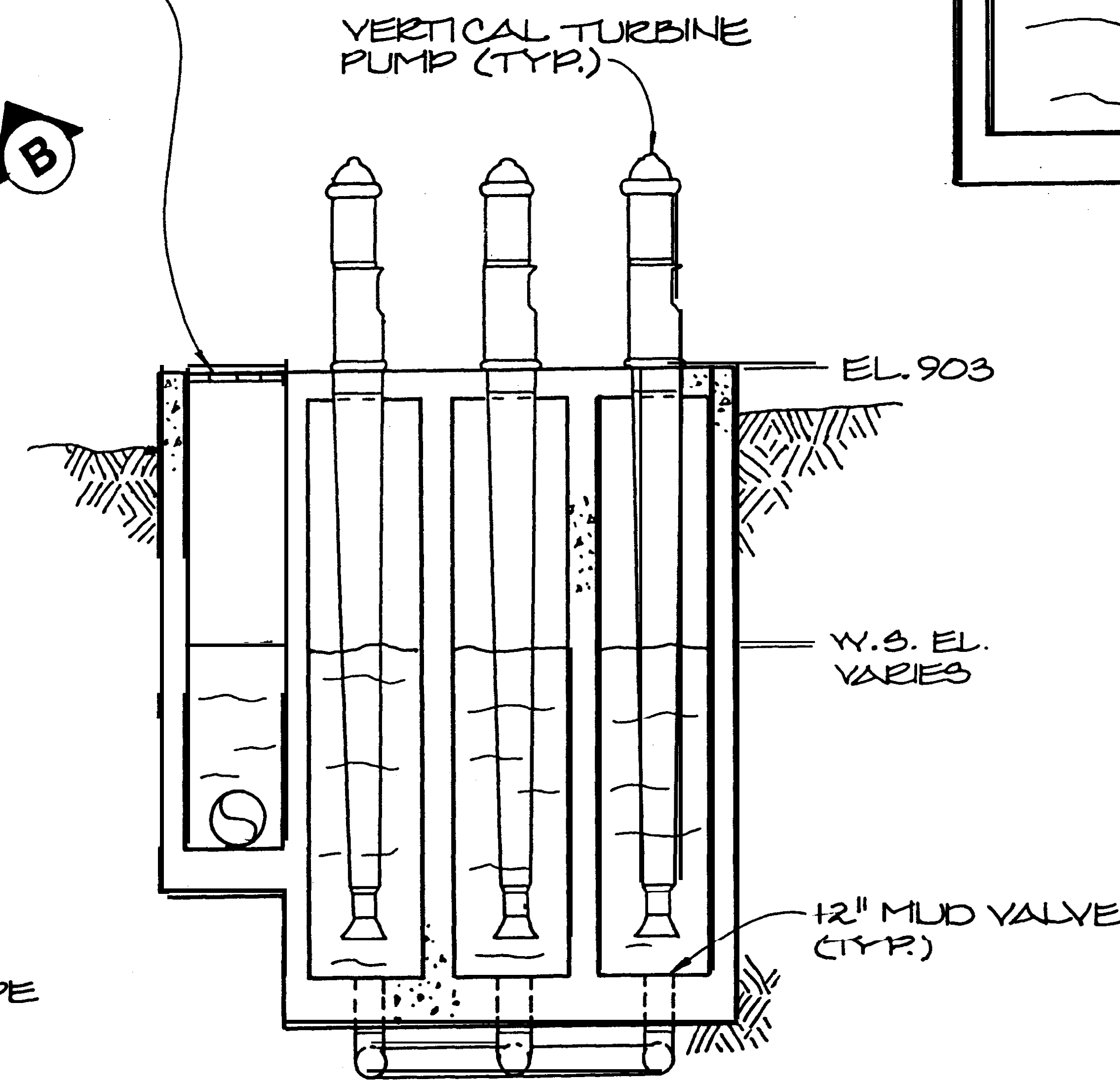
**SITE PLAN**

**SUNNYSIDE ASPHALT PONDS**

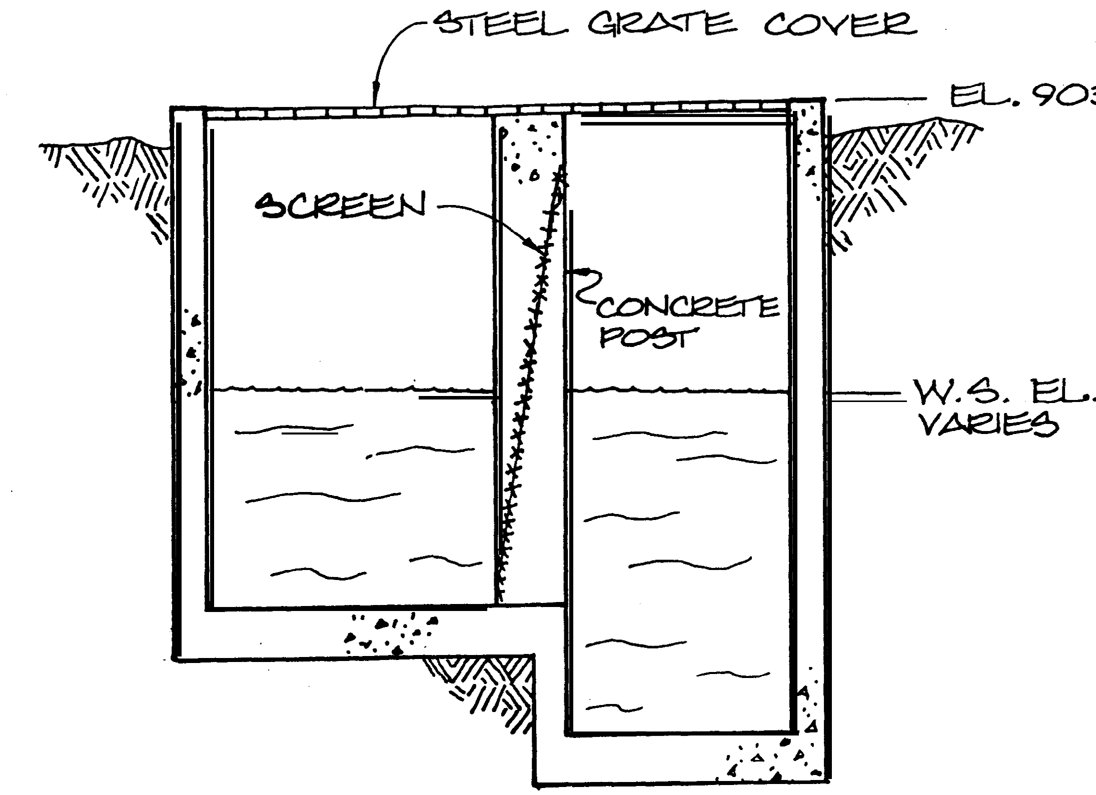
FIGURE 4




## PLAN




## SECTION A




## SECTION B

## DETAILS
## SUNNYSIDE PUMP STATION

AFA.WB

FIGURE 5

# APPENDIX A

# CORRESPONDENCE

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 22, 1987

United Telephone Company
601 State Street
Hood River, Oregon 97031

Attention: Ms. Liz Moore, MS63

Subject: Prosser & Sunnside Acclimation Facilities

Dear Ms. Moore,

This is to inquire about the availablity and cost for telephone service to two sites. One is adjacent to the Yakima River and Interstate Highway 82 near Prosser, Washington. The other is at Sunnyside Dam on the Yakima River near the community of Parker, Washington. Locations are shown on the enclosed drawings. Both sites are undeveloped and to my knowledge there are no telephone lines nearby.

Sverdrup is preforming a chinook salmon fry rearing feasibility study for the U.S. Fish and Wildlife Service and these sites are two of several being considered. There will be housing for the facility manager and the need is for a residential hook up only. Fry rearing will occur during May and adult capture and spawning will last six to eight weeks in October and November. These are the only times the sites will be used.

At your earliest convenience please send me a letter that gives an approximate cost for providing this telephone service.

Please let me know if you have questions. Thank you for your assistance.

Very truly yours,

SVERDURP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosure

United Telephone System

United Telephone of the Northwest
601 Slate Street l Hood River. Oregon 97031

June 4, 1987

Harold T. Andersen, PE
Sverdrup Corporation
1200 112th Avenue NE
P 0 Box 369
Bellevue, Washington 98009

Dear Mr. Anderson: Prosser + Sunnyside

Reference is made to your letter of May 22, 1987. From the maps provided, it would appear that service can be provided to both sites at no additional cost other than basic line connection charges ($25.00). However, our engineer in Sunnyside informs me that without surveying the actual location this is an assumption at best.

Should a line extension become necessary, the following applies:

we will extend a line 528 feet (l/lOth mile) on a public road at no charge

we will extend a line 120 feet on a private road at no charge

a charge of $1.00 per foot will apply for distances beyond the above

I might suggest that you contact our office in advance of placing an order for service. Our facility technician can arrange to meet you at these locations and can determine at that time if a line extension would be necessary. We need at least one weeks' notice and arrangements can be made by calling out business office at 503 387-6904.

If I can be of further assistance, please call me at the above number.

Sincerely,

Liz Moore

Liz Moore
Service Representative

:em

RECEIVED
JUN - 8 1987
SVERDRUP CORP.
SEATTLE OFFICE

Sverdrup
CORPORATION

1200 112th Avenue, N.E
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 21, 1987

Pacific Power and Light
1101 North 16th Avenue
Yakima, Washington 98902

Attention: Mr. Dean Laurvick

Gentlemen:

Subject: Power Service
Sunnyside Acclimation Facility

This is to inquire about the availability and cost for power service to a site on the Yakima River at the Sunnyside Dam near the town of Parker, Washington. Our facilities would be just upstream of the dam on the south side. The project area is shown on the enclosed drawing.

Sverdrup is performing a chinook salmon fry rearing feasibility study for the U.S. Fish & Wildlife Service and this site is one of several being considered. The power requirement is approximately 50 horsepower for pumping, 3 horsepower for a fish food freezer and probably a 200 amp service for a residence and low level outdoor lighting. This facility would only operate during May and for six to eight weeks in October and November.

At your earliest convenience, please send me a letter that gives an approximate cost for providing this electric service. Also, please include your power rates so that we can estimate operational costs.

Please let me know if you have questions. Thank you for your assistance.

Very truly yours,

SVFRDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosure

PACIFIC POWER & LlGHTCOMPANY
P.O. BOX 1729
YAKIMA. WASHINGTON 98907

September 1, 1987

PACIFIC POWER

Ted Nyberg
Estimator

1101 North 16th Avenue (98902)
P.O. Box 1729
Yakima, WA 98907
(509) 575-3156

Sverdrup Corporation
1200 112th. Ave. N.E.
P.0, Box 369
Bellevue, Wa. 98009

ATT: GARY WIGGINS

Gentlemen:

Subject: Power Service
Sunnyside Acclimation Facility

After further study we have come up with three possible alternatives for getting power to the facilities you requested.

1. Take service at the existing facilities on the Northside of the river and run your own service across the river. No cost from Pacific Power.

2. Bring a three phase line across the river from the North, $5,000 (approx, 900'). This would require additional Right of Ways and Permits,

3. Three phase an existing single phase line to the South, $13,000 (Approx. 4600'). This also would require additional Right of Ways and Permits.

Option One (1) seems the most economical and practical when looking at the customers and Pacific's alternatives. There is an available service that crosses the river at this site. We assume it belongs to the customer that operates the existing facility.

Using our distribution circuit maps scales at 1″=400′, it would seem your service would be approximately 700'. Using this distance and assuming you ran l-l/O aluminum Quad Service, your voltage drop will be less than 4%.

Yours very truly,

Ted Nyberg

TED NYBERG

TN/ma
encL 2

PACIFIC POWER & LIGHT COMPANY

For Commission's Receipt Stamp

SCHEDULE 24
GENERAL SERVICE

AVAILABLE:

In all territory served by Company in the State of Washington.

APPLICABLE:

To non-residential customers whose entire requirements (including or excluding water heating) are supplied hereunder. Deliveries at more than one point, or more than one voltage and phase classification, will be separately metered and billed.

Emergency, Frost Protection, and Remote Service will be furnished by contract in accordance with Rule 2.(a) of this tariff.

This schedule is not applicable to standby or breakdown service.

MONTHLY BILLING:

The Monthly Billing shall be the sum of the Basic, Demand, Energy, and Reactive Power Charges:

BASIC CHARGE:

| If Load Size* Is: | The Monthly Basic Charge* Is: Single Phase | Three Phase |
|---|---|---|
| 10 kw or less | $3.75 | $5.50 |
| Over 10 kw | $3.75 plus $.50 per kw for each kw in excess of 10 kw. | $5.50 plus $.50 per kw for each kw in excess of 10 kw. |

*Note: Kw load size, for the determination of the Basic Charge, shall be the average of the two greatest non-zero monthly demands established any time during the 12-month period which includes and ends with the current billing month.

ENERGY CHARGE:

| Winter | Summer | |
|---|---|---|
| 7.850¢ | 7.137¢ | Per kwh for the first 85 kwh per kw of demand but for not less than the first 1,000 kwh. |
| 5.064¢ | 4.604¢ | Per kwh for the next 8,000 kwh. |
| 4.251¢ | 4.251¢ | Per kwh for all additional kwh. |

(Continued)

Issued March 2, 1987 Effective March 19, 1987

Issued by PACIFIC POWER & LIGHT COMPANY

By Fredric D. Reed Title Senior Vice President

TF2 24.1E

PACIFIC POWER & LIGHT COMPANY

For Commission's Receipt Stamp

SCHEDULE 24
(Continued)
GENERAL SERVICE

.

SEASONAL DEFINITION:
Winter months are defined as the six regular billing months November through April. Summer months are defined as the six regular billing periods May through October. In 1986 the summer and winter months will begin with regularly scheduled meter readings on April 29, 1986, and October 29, 1986, respectively.

MINIMUM CHARGE:
The monthly minimum charge shall be the Basic Charge. A higher minimum may be required under contract to cover special conditions.

REACTIVE POWER CHARGE :
The maximum 30-minute reactive demand for the month in kilovolt amperes in excess of 40% of the kilowatt demand for the same month will be billed, in addition to the above charges, at 45¢ per kvar of such excess reactive demand.

DEMAND:
The kw shown by or computed from the readings of Company's demand meter for the 30-minute period of the customer's greatest use during the month determined to the nearest kw.

CONTINUING SERVICE:
Except as specifically provided otherwise, the rates of this tariff are based on continuing service at each service location. Disconnect and reconnect transactions shall not operate to relieve a seasonal customer from monthly minimum charges.

RULES AND REGULATIONS:
Service under this schedule is subject to the General Rules and Regulations contained in the tariff of which this schedule is a part and to those prescribed by reulatoryauthorities.

Issued February 27, 1986 Effective March 29, 1986

Issued by PACIFIC POWER & LIGHT COMPANY

BY Fredric D. Reed Title Vice Presidnet

Form F TF2 24.2E

# APPENDIX B

## FLOW RECORDS, FLOOD PREDICTIONS

## KEY TO MAP

| | |
|---|---|
| 500-Year Flood Boundary | |
| 100-Year Flood Boundary | |
| FLOODWAY FRINGE | FLOODWAY |
| 100-Year Flood Boundary | |
| 500-Year Flood Boundary | |
| Approximate 100-Year Flood Boundary | |
| Cross Section Line | A — A |
| Elevation Reference Mark | RM7 × |
| River Mile | • M1.5 |

APPROXIMATE SCALE

1000 0 1000 FEET

### NOTES TO USER

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

This map was prepared to facilitate flood plain management activities only; it may not show all special flood hazard areas in the community or all planimetric features outside of the flood plain. Refer to the latest official Flood Insurance Rate Map for any additional areas of special flood hazard.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

For adjoining map panels, see separately printed Index to Map Panels.

PANEL 1405 OF 2575
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
530217 1405

EFFECTIVE DATE:
JUNE 5, 1985

Federal Emergency Management Agency

SUNNYSIDE DAM

NATIONAL FLOOD INSURANCE PROGRAM

# FLOODWAY

## FLOOD BOUNDARY AND FLOODWAY MAP

## YAKIMA COUNTY, WASHINGTON
(UNINCORPORATED AREAS)

PANEL 1410 OF 2575
(SEE MAP INDEX FOR PANELS NOT PRINTED)

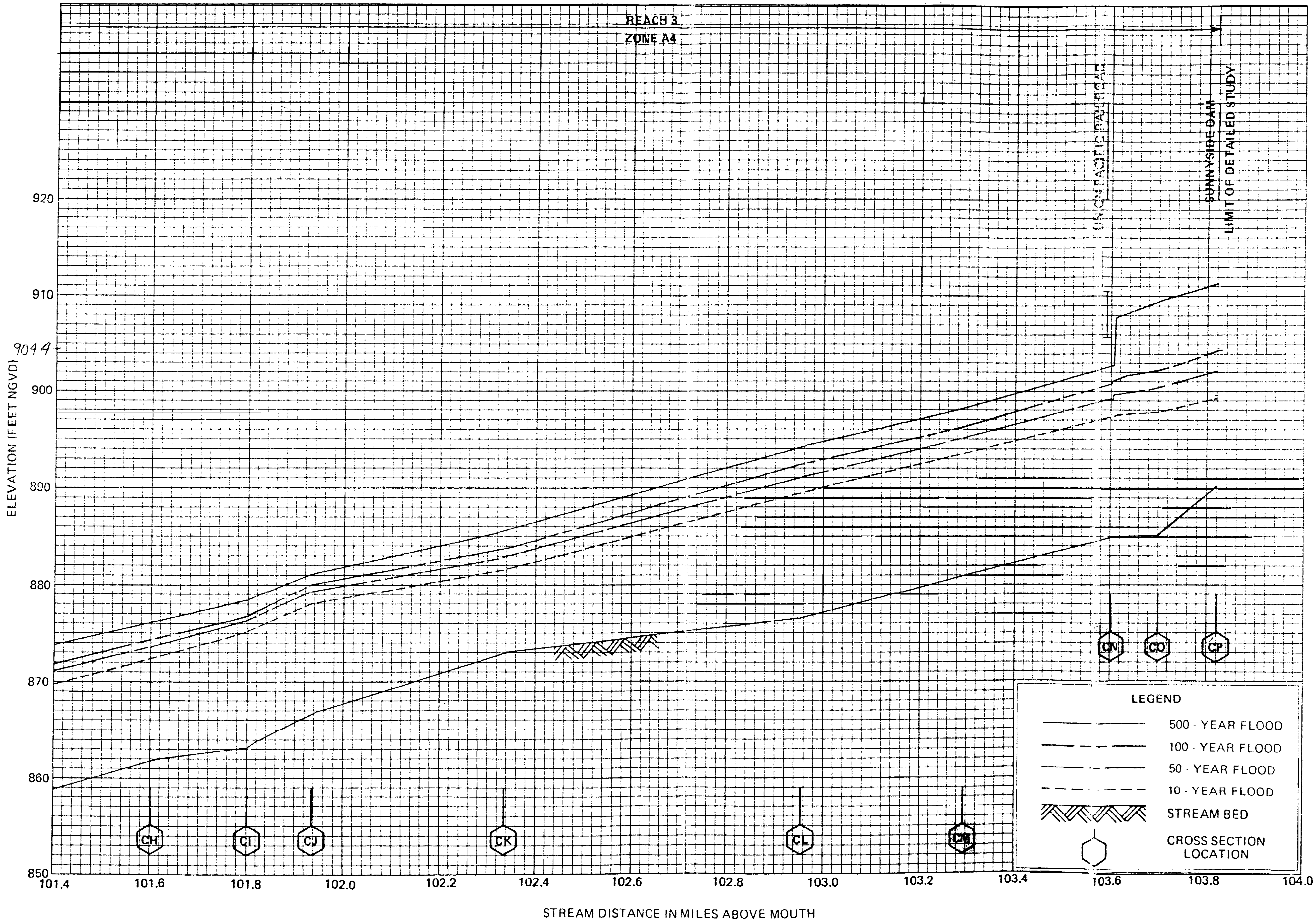
COMMUNITY-PANEL NUMBER
530217 1410

EFFECTIVE DATE:
JUNE 5, 1985

Federal Emergency Management Agency

SUNNYSIDE DAM


Sunnyside Dam
JOINS PANEL 1070
27
26
SUNNYSIDE CANAL
CM
CL
CK
CJ
CI
CH
CG
CF
CE
CD
YAKIMA
RIVER
34
33
35
4
UNION
PACIFIC
BURLINGTON
NORTHERN
PARKATO
ROAD
DONALD
ROAD
YAKIMA
82
12
410




FLOOD PROFILES

YAKIMA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAKIMA COUNTY, WA
(UNINCORPORATED AREAS)

20P

United States Department of the Interior

BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550WEST FORT STREET
BOISE,IDAHO 83724

IN REPLY REFER TO: PN 769

NOV 6 1986

Arnold Marquez
Sverdrup Corporation
P.O. Box 369
Bellevue, Washington 98009

Dear Mr. Marquez:

Enclosed are the hydrographs and rating curves for various locations on the Yakima River which you requested by telephone on October 31. We hope that they are helpful to you in your analysis of habitat areas.

If you have any questions, please contact Jim Doty of our office at (208) 334-1339.

Sincerely yours,

Robert J. Riley
Acting Regional Planning Officer

Enclosures

RECEIVED
NOV 10 1986
SVERDRUP & PARCEL
& ASSOCIATES INC.

From "Flood Insurance Study" Yakima County, Wa. by FEMA

Table 2. Summary of Discharges

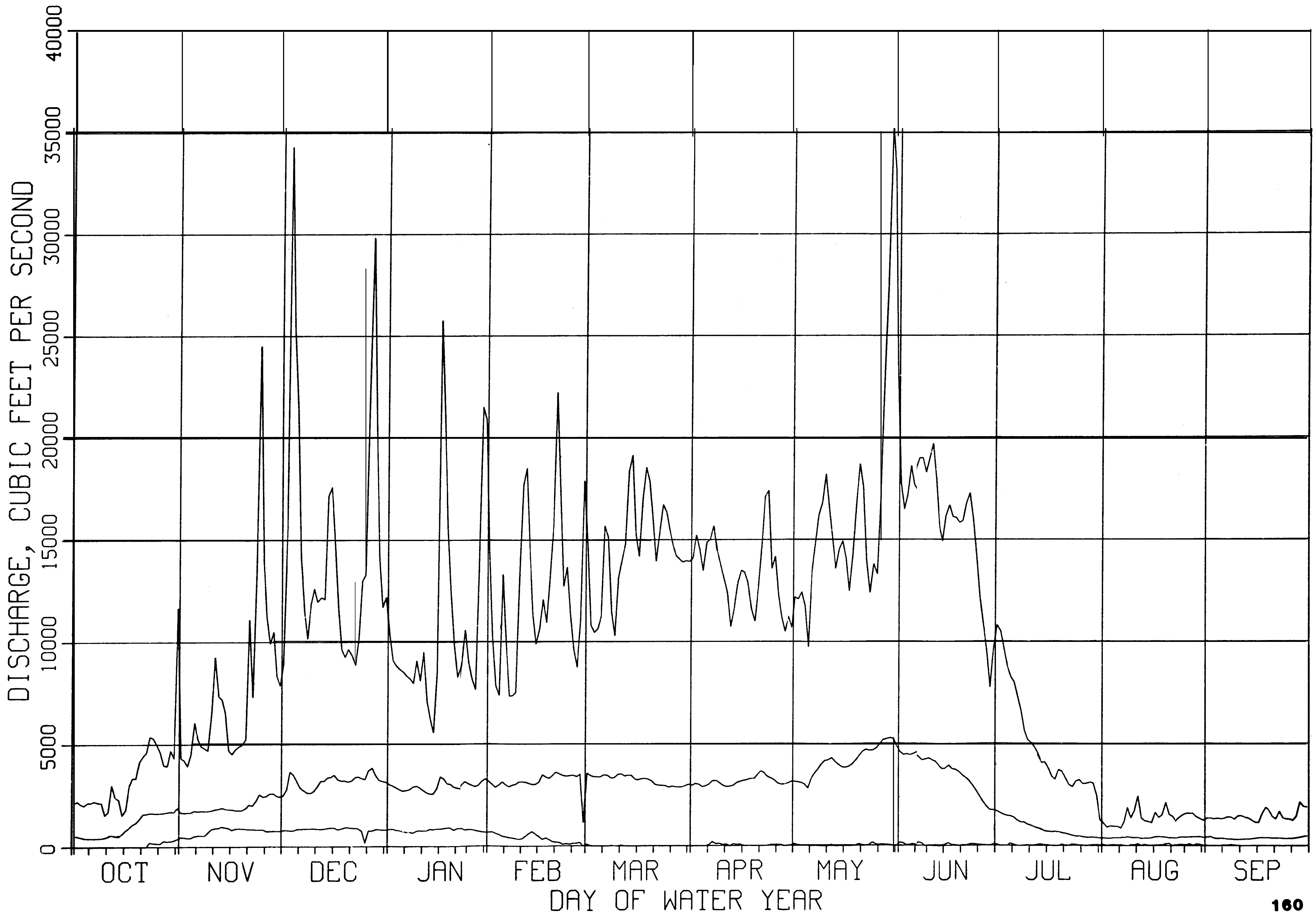
| Flooding Source and Location | Drainage Area (Square Miles) | Peak Discharges (Cubic Feet per Second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| **Yakima River** | | | | | |
| Upstream of Confluence With Naches River | 2,112 | 15,900 | 26,700 | 35,300 | 58,900 |
| At Parker | 3,633 | 26,000 | 43,500 | 55,000 | 96,000 |
| **Naches River** | | | | | |
| Downstream of Confluence With Tieton River (Near Naches) | 941 | 12,500 | 20,000 | 27,000 | 47,500 |
| At Mouth | 1,125 | 12,600 | 20,300 | 27,100 | 49,400 |
| **Ahtanum Creek** | | | | | |
| At Upstream Study Limit | 119 | 950 | 1,750 | 2,250 | 4,100 |
| At Union Gap | 173 | 1,100 | 2,200 | 2,850 | 5,200 |
| **Wide Hollow Creek** | | | | | |
| Near Harwood | 32.4 | 100 | 220 | 320 | 750 |
| At Burlington Northern Railroad Bridge (Near Union Gap) | 65.7 | 220 | 450 | 640 | 1,450 |
| **Bachelor Creek** | | | | | |
| At Confluence With Ahtanum Creek | --[1] | 550 | 1,100 | 1,725 | 3,100 |
| **North Fork Ahtanum Creek** | | | | | |
| At Mouth | 68.9 | 700 | 1,240 | 1,600 | 2,900 |
| **Spring Creek 2** | | | | | |
| At Confluence With Wide Hollow Creek | [1] | 250 | 275 | 285 | 2,400 |

[1] Data Not Available

# YAKIMA R NR PARKER

(BELOW SUNNYSIDE DIVERSION DAM)

## MEAN, MINIMUM AND MAXIMUM



# APPENDIX C

## WATER QUALITY RESULTS

am test inc.
14603 N.E. 87th St. • REDMOND, WASHINGTON 98052 • 20618851664

ANALYSIS REPORT

CLIENT: Sverdrup Corporation

DATE RECEIVED: 5/20/87

REPORT TO: Harold Anderson
P.O Box 369
Bellevue, WA 98009

| Laboratory Sample Numbers | 705567 | 705568 | 705569 |
|---|---|---|---|
| Client Identification | Sunnyside | WB R | WB Wastewater |
| Alkalinity (mg/l as $CaCO_3$) | 37. | 59. | 237. |
| Chloride (mg/l) | 2.8 | 3.3 | 31. |
| Ammonia - Nitrogen (mg/l) | 0.048<br>0.051 ] | 0.095 | 0.023 |
| Nitrate + Nitrite (mg/l) | 0.720 | 0.500 | 0.690 |
| Nitrite (mg/l) | 0.005 | 0.004 | 0.001<br>0.001 3 |
| Dissolved Oxygen (mg/l) | 12.10 | 12.30 | 7.35 |
| Total Suspended Solids (mg/l) | 4. | 27. | 9. |
| Settleable Solids (mg/l) | <0.1 | 0.1 | 0.1 |
| Total Kjeldahl Nitrogen (mg/l) | <0.200 | 0.833 | 0.550 |
| Total Dissolved Solids (mg/l) | 143. | 132. | 482. |
| PH | 8.0 | 8.1 | 8.9 |
| Copper (mg/ 1) | 0.004 | 0.007<br>0.005 ] | 0.001 |
| Zinc (mg/l) | 0.013 | 0.060<br>0.060 1 | 0.048 |

REPORTED BY John Dailey

JD/pb

# JOHN DAY FALL CHINOOK/SALMON MITIGATION PLAN
# ACCLIMATION AND IMPRINTING
# SITE FEASIBILITY STUDY
# PROSSER JUVENILE TRAP SITE

**Completion** Report

**by**

U.S. FISH AND WILDLIFE SERVICE
Portland, Oregon

and

SVERDRUP CORPORATION
Bellevue, Washington

Funded by

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
DIVISION OF FISH AND WILDLIFE
CONTRACT NO. 14-16-0001-84078
PROJECT NO.________

September 1987

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## APPENDICES

# INTRODUCTION

The Prosser Juvenile Trap area is one of 10 locations being considered for an acclimation facility as part of the John Day Fall Chinook Salmon Mitigation Plan. This report presents results from an engineering feasibility study of the Prosser site.

# II SITE INFORMATION

## A. location

Prosser Juvenile Trap is located adjacent to the Yakima River in Benton County, Washington within the Prosser City limits. The site is in Section 36, Township 9 North, Range 24 East, at Yakima River mile 46. The proposed site is on the north side of the Yakima River between the River and Chandler Canal. U.S. Interstate 82 crosses land immediately east of the site. Figure 1 is a Location Map and Figure 2 is a Vicinity Map for the Prosser site.

## B. Land Ownership

The proposed acclimation facility is on privately owned land and land owned by the City of Prosser. All property in the project vicinity is undeveloped and it is classified open space. The city ownership is for road rights-of-way. (Ownership information and property maps are in Appendix B.)

## C. Site Description

The project site is on gently sloping land between the Chandler Canal and the Yakima River and adjacent to Interstate Highway 82. It is near an abandoned fish screening structure on the canal and a sampling and enumerating facility close to the river. The screen and sampling station have been replaced by a new facility approximately 3,000 feet upstream on Chandler Canal, owned by the U.S. Bureau of Reclamation and operated by the Yakima Indian Nation. Further upstream is the Prosser sewage treatment plant.

The site is dry with sparse vegetation except for one wet area, presumably fed by a leak in the fish screen to sampling station pipeline. A no longer used gravel pit it also nearby.

D. Access and Services

Access to the project site is good. The site can be reached from either side of U.S. Interstate 82. The southwest approach is the best. At the north end of the Grant Avenue bridge a gravel access road can be followed east. The road, owned by Kennewick Irrigation District for Chandler Canal access, passes over the canal by means of a small bridge adjacent to the Grant Avenue bridge. This road parallels Chandler Canal for a mile to the proposed project site. A large diameter pipe culvert under Interstate 82 to allow access from the northeast.

The site is in the Prosser City limits and local services are available. Full services can also be obtained in the Tri-Cities area (26 miles east) or in Yakima (45 miles northwest).

## E. Soils and Vegetation

The USDA Soil Conservation Service has classified three predominant soil types in the area. These are Finley fine sandy loam, Finley stony fine sandy loam, and Scooteney silt loam. These soils are common in cropland or range uses and they are expected to be suitable for supporting the required structures.

Vegetation at the site mainly consists of sparse grass cover. Trees and shrubs line the river bank.

## F. Flood Levels

The Federal Emergency Management Agency (FEMA) has predicted 101-, 50-, and 100-year recurrence interval floods at Benton City, 14 miles downstream on the Yakima River from Prosser, as follows:

| Recurrence Interval | Flood Discharge |
|---|---|
| 10 Years | 26,100 cfs |
| 50 Years | 44,000 cfs |
| 100 Years | 55,500 cfs |

Other FEMA reports show these same flood discharges many miles upstream of the Prosser site at Parker near Yakima. Records show that most flooding on the Yakima River occurs during the spring rains and snow melt in April, May, and June. Since Prosser is between these two sites on the Yakima River, these flood flows are applicable.

FEMA has also prepared river plan and profile drawings indicating flood elevations at the proposed site. These drawings are in Appendix C. The acclimation ponds or raceways can easily be located above the l00-year flood elevation of 613.5 feet.

G. Utilities

The Prosser Trap Juvenile site is within the United Telephone System (UTS) and the Benton County Public Utility District (BCPUD) service areas. UTS is headquartered in Hood River, Oregon and BCPUD is in Kennewick, Washington. Telephone and electric service both exist on the site at the old fish screen facility. Both companies have provided cost estimates for furnishing service (refer to Appendix A).

Domestic water would probably come from a shallow well on-site, however, the availability of acceptable quality/quantity ground water has not been verified. Sewage disposal would be via a septic tank and drainfield.

H. Cultural Resources

The Prosser site was a prime fishing area for early Native Americans and pioneer settlers. It is likely that cultural resources are present which could be disturbed by construction.

Therefore, it is recommended that a professional archaeologist monitor the Prosser site during construction (refer to the Cultural Resource Overview in the Summary Report).

## III PRODUCTION GOALS

Initial studies of sites along the Yakima River were based on their use for acclimation of l,OOO,OOO (11,000 pounds at 90 per pound) of bright fall chinook. Fish would be trucked to the site for acclimation from the end of April to the end of May each year. Two to three groups of fish would arrive at the site and be held for one to two weeks before being released to the river. With this use for the facility, initial site planning was .based on a standard half-acre rearing pond with a water supply of approximately 10 cfs.

The draft Yakima Central Outplanting Facility Master Plan indicates that the Prosser Juvenile Trap site was to be used for evaluating acclimation times, release, location, and time of release. Five experimental lots of 200,000 fall chinook were tentatively planned to be held and released at the Prosser site.

Since the purpose of this study is to evaluate all alternative sites for acclimation on an equal basis, it was important to compare them using the same basic criteria. Therefore, the Prosser Juvenile Trap site was evaluated on the same basis for production as other sites with adequate water supplies. This production criterion is the capability to provide acclimation for 30,000 pounds of fry or smolts in four 7,500-pound lots.

# IV DEVELOPMENT CONCEPTS

Fry rearing in ponds or raceways is the most appropriate development concept at Prosser. Water based facilities were not considered feasible in the Yakima River because of strong currents and limited space.

## A. Site Selection

The potential area for development is large and level and the only site selection constraint is the elevation of flood waters. As shown in Figures 3 and 4 the facility is located above the l00-year flood at elevation 613.5.

## 8. Water Supply

The concept presented uses 15 cubic feet per second gravity water flow from the Chandler Canal. A 24 inch pipe conveys water from the old fish screening structure to the facility and then to the Yakima River. The existing pipe between the screens and the sampling station leaks and is no longer serviceable. However, it may be possible to use a very short portion where it penetrates the screen structure, The invert of this pipe is at the bottom of the canal and to avoid sediment it may be preferable to make a new penetration 1 or 2 feet higher. This decision can be made during final design.

A major obstacle to development at Prosser is obtaining a right to use 15 cfs from Chandler Canal. The canal is owned by the USBR and flow is used for hydroelectric generation and irrigation by the Kennewick Irrigation District (KID). A water right permit must be issued by the Washington Department of Ecology (WDOE) with concurrence by the USBR and the KID. Each of these agencies have been contacted and the correspondence is in Appendix A. The KID said it would not approve of this water use. The WDOE cited current water rights adjudication and their policy of issuing only temporary permits until a settlement is reached, which could take several years. The USBR provided historic flow data, information on current flow entitlements, and details regarding the old fish screening facility. However, they were noncommittal on whether or not they would agree to allow water use for fry acclimation.

C. Raceways or Ponds

As stated, land based raceways or ponds are recommended for the Prosser site. A 15 cfs facility is proposed to allow equal comparison with other sites. This flow would be provided to eight-10 by 100 by 3.5 foot deep concrete raceways or four-40 by 80 by 4 foot deep asphalt ponds. Site plans are shown in Figures 3 and 4 and specific details are in the Summary Report. Also included in the Cost Summary section are alternative vinyl raceways or membrane lined ponds.

Adult capture facilities are included with this project to allow equal comparison with other sites. However, it may be more cost effective to modify the existing Prosser dam fish ladder for adult capture and spawning. This alternative is considered beyond the scope of this project and therefore it was not investigated. An alternative adult capture and spawning location may also be desirable if Chandler Canal water is not sufficiently unique to imprint the fish.

## V WATER QUALITY' AND TEMPERATURE

On May 3, 1987, water samples were collected from Chandler Canal next to the old fish screen facility. These were taken to AM Test, Inc. in Redmond, Washington for analysis. Results are in Appendix D.

The water had concentrations of ammonia and zinc in excess of the maximum desired level listed in the U.S. Fish & Wildlife proposal to the Bonneville Power Administration. The water temperature on May 4, 1987 at 11:30 A.M. was 57 degrees F and on May 19, 1987 it was 60 degrees F.

# VI COST SUMMARY

A construction cost summary, exclusive of land acquisition or professional services fees for the raceways and ponds alternatives, is shown in Table 1.

- TABLE 1 -

PROSSER JUVENILE TRAP COST SUMMARY

| | Concrete Raceways | Asphalt Ponds | Membrane Ponds | Vinyl Raceways |
|---|---|---|---|---|
| Site Preparation | $ 72,600 | $ 91,600 | $ 91,600 | $ 72,600 |
| Ponds or Raceways | 247,000 | 93,200 | 79,700 | 205,700 |
| Extra for Adult Capture | | 21,000 | 21,000 | - |
| Office/Housing | 12,500 | 12,500 | 12,500 | 12,500 |
| Food Freezer/Prep. Bldg.* | 48,900 | 48,900 | 48,900 | 48,900 |
| Standby Generator | 2,100 | 2,100 | 2,100 | 2,100 |
| Electric Utility | | | | |
| Telephone Utility | 100 | 100 | 100 | 100 |
| Subtotal | 383,200 | 269,400 | 255,900 | 341,900 |
| 15% Contingency | 57,500 | 40,400 | 38,400 | 51,300 |
| Total | $440,700 | $309,800 | $294,300 | $393,200 |
| Monthly Power Cost | 143 | 143 | 143 | 143 |

* Portable Freezer Van Alternative Cost = $41,500

# VII ADVANTAGES AND DISADVANTAGES

The Prosser site has the following advantages and disadvantages.

All flow can be by gravity, however, Kennewick Irrigation District will not allow use of Chandler Canal water.

There may be additional complications in obtaining a water right due to pending water use litigation.

There are potential fish health problems.

The site is generally good for access and the availability of utilities.

Canal water has excess concentrations of ammonia and zinc.

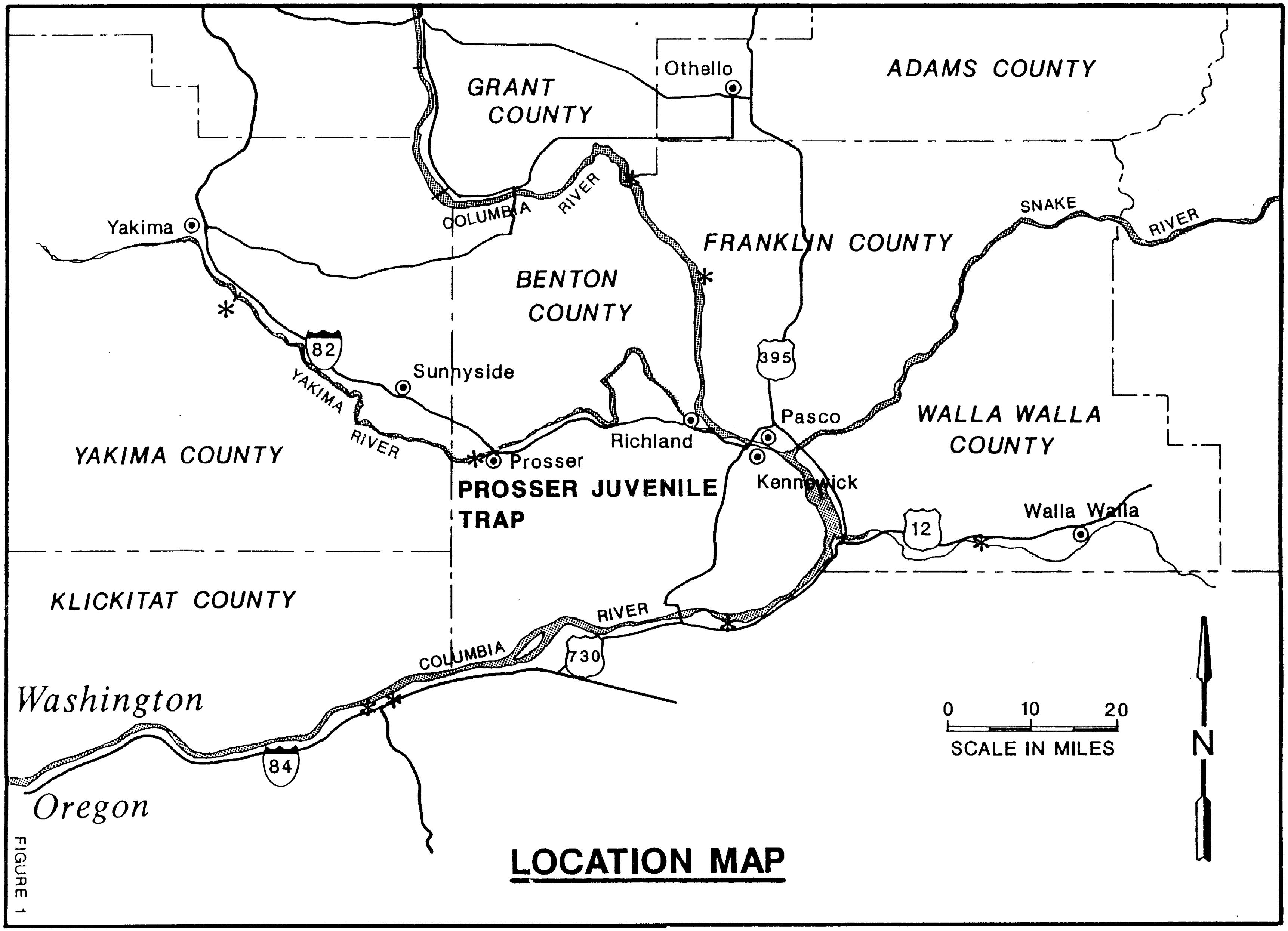
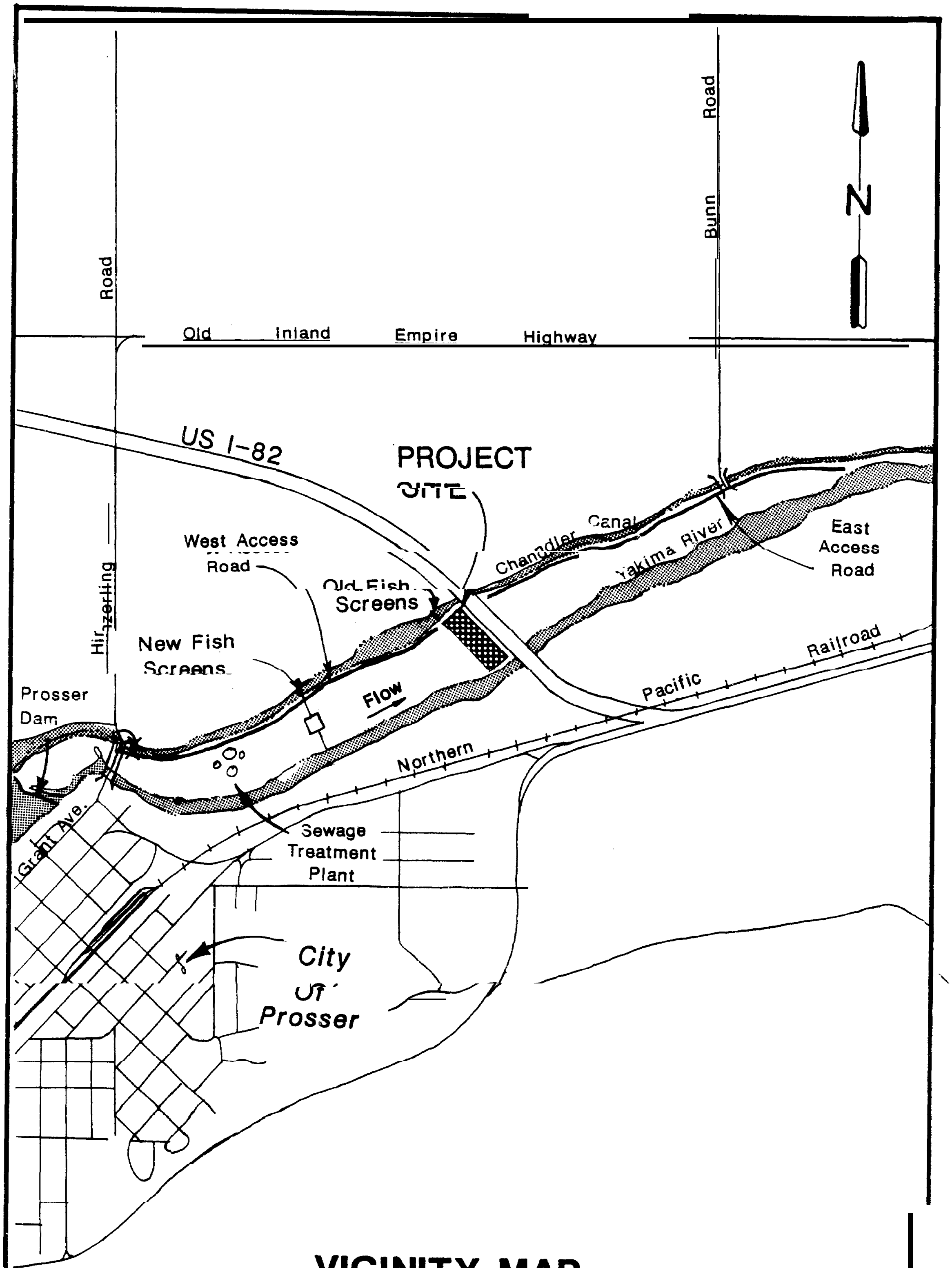

GRANT COUNTY
Othello
ADAMS COUNTY
Yakima
COLUMBIA RIVER
FRANKLIN COUNTY
SNAKE RIVER
BENTON COUNTY
82
YAKIMA RIVER
Sunnyside
395
Pasco
WALLA WALLA COUNTY
Richland
YAKIMA COUNTY
Prosser
Kennewick
PROSSER JUVENILE TRAP
12
Walla Walla
KLICKITAT COUNTY
COLUMBIA RIVER
730
Washington
0 10 20
SCALE IN MILES
N
84
Oregon
LOCATION MAP

FIGURE 1

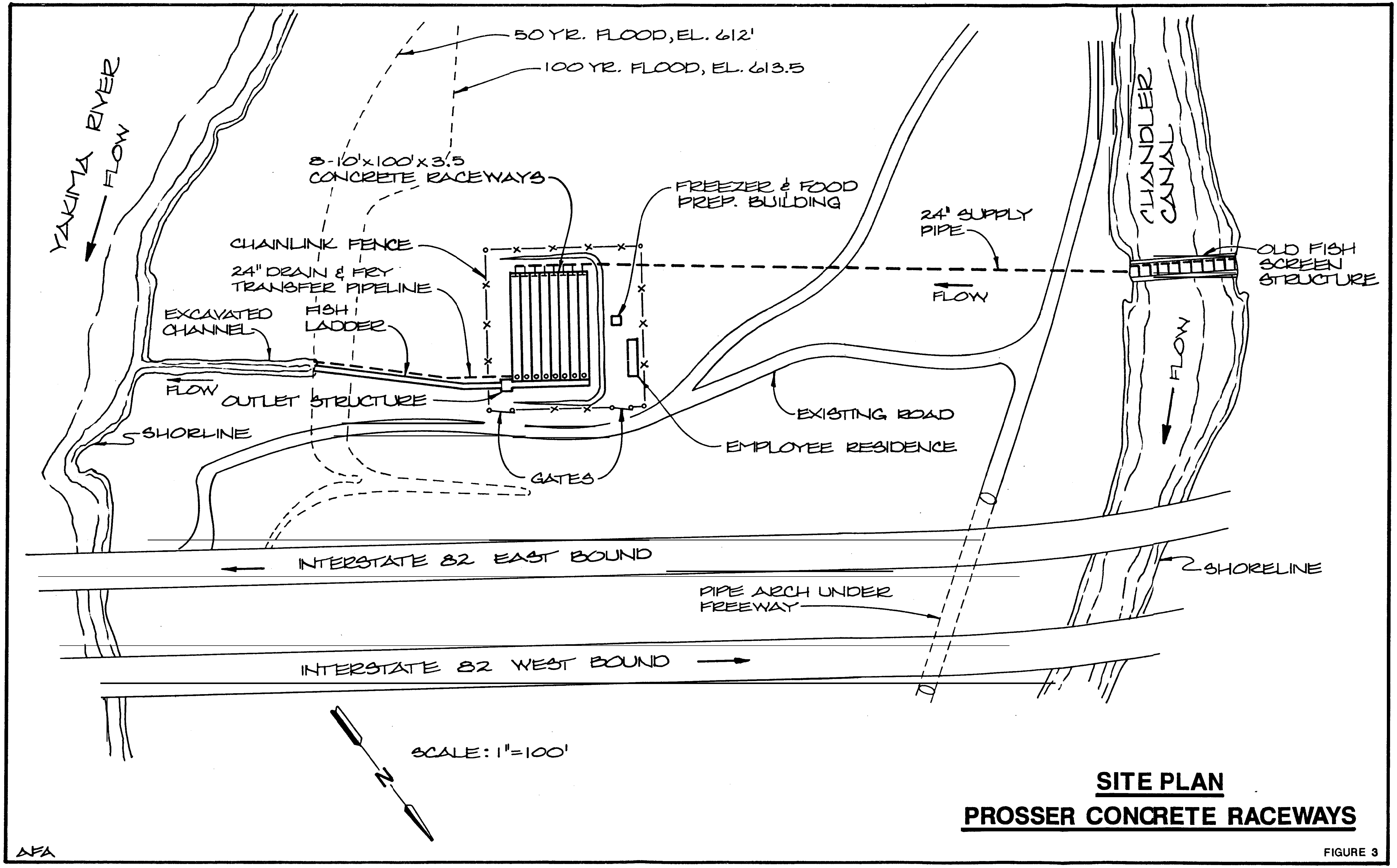



**VICINITY MAP**

**PROSSER JUVENILE TRAP**

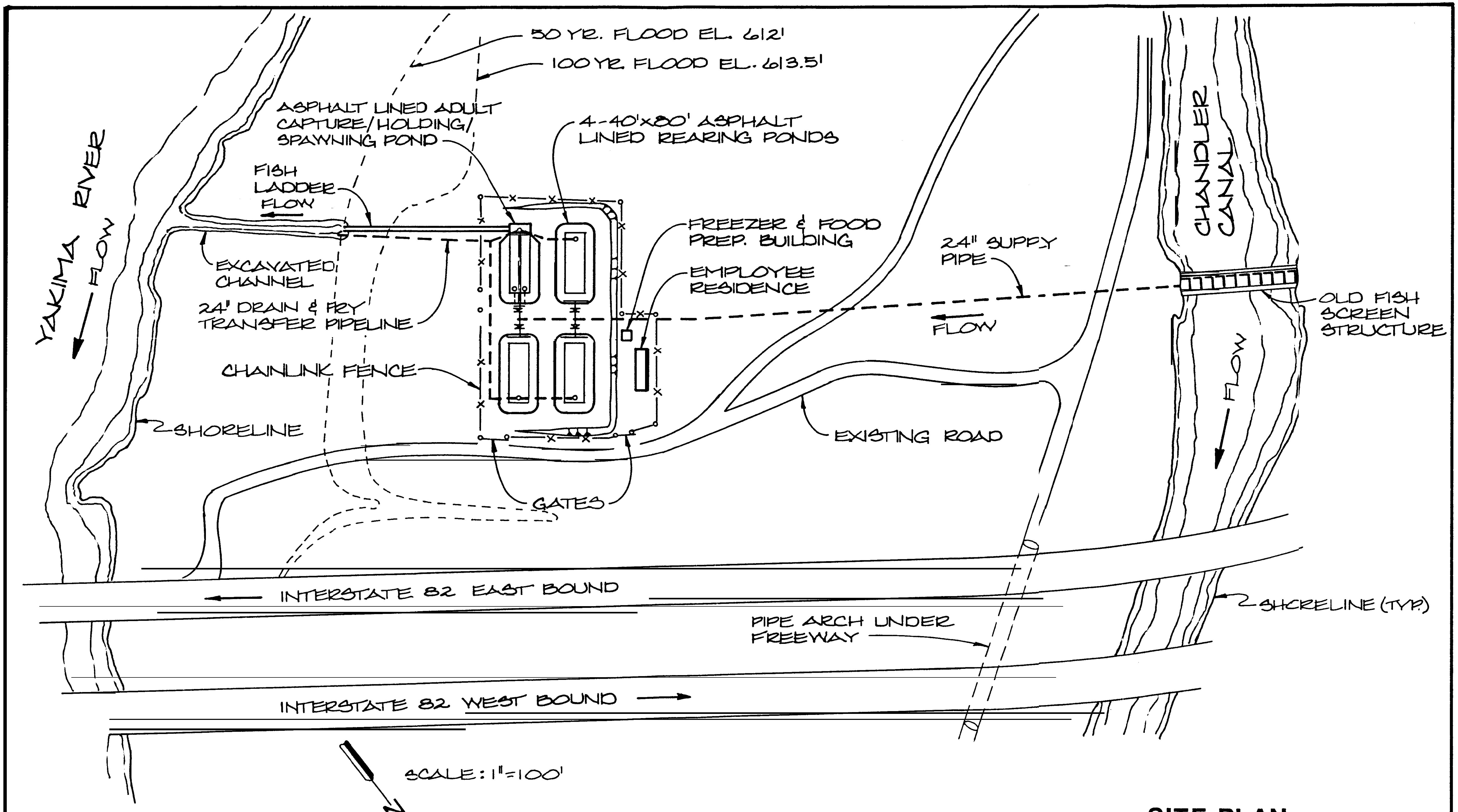
SCALE: 1"=2000'

FIGURE 2




**SITE PLAN**
**PROSSER CONCRETE RACEWAYS**

FIGURE 3




**SITE PLAN**
**PROSSER ASPHALT PONDS**

FIGURE 4

# APPENDIX A

# CORRESPONDENCE

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
Bellevue, Washington 98009

206 454-9562

December 1, 1986

Bureau of Reclamation
1917 Marsh Road
Yakima, Washington 98901

Attention: Mr. Chuck Keller

Gentlemen:

Subject: John Day Acclimation Pond Study
Prosser Juvenile Trap Site

Sverdrup Corporation is under contract to the U.S. Fish and Wildlife Service to prepare feasibility studies for salmon acclimation facilities at sites along the Yakima and Columbia Rivers. One of the sites being studied is known as the Prosser Juvenile Trap Site and is located adjacent to Interstate 82, southwest of the freeway between Chandler Canal and the Yakima River.

The acclimation period for the pond at Prosser will be during the month of May each year. During that month, up to ten tanker truck loads of fish will be transferred from a hatchery to the pond for acclimation and release to the river. The water requirements for operation of the facility are estimated at ten to twenty cubic feet per second (cfs), depending on the extent of site development. The most economical source for this water supply would be from Chandler Canal using the pipeline from the existing canal screening structure. For our feasibility studies, we need the following information.

1. What is the yearly water delivery schedule for Chandler Canal?

2. Would your agency permit water withdrawals from Chandler Canal during the month of May of each year and at what flow rate?

3. If a water withdrawal is permitted by your agency, are there other agencies or irrigation districts that must also approve the withdrawal? Who should we contact at the other agencies or irrigation districts?

Please contact us if you need additional information.

Very truly yours,

SVERDRUP CORPORATION

Glen M. Aurdahl

Glen M. Aurdahl, P.E.
Project Manager

cc: Bill Striplin

United States Department of the Interior

BUREAU OF RECLAMATION
YAKIMA PROJECT OFFICE
1917 MARSH ROAD
P.O. BOX 1749
YAKIMA, WASHINGTON 98907-1749

IN REPLY REFER TO: 150/700
565.

December 18, 1986

509-575-55

RECEIVED
DEC 22 1986
SVERDRUP & PARCEL & ASSOCIATES INC.

Sverdrup Corporation
1200 112th Ave. NE
Suite Cl43
Bellevue WA 98009
Attn: Mr. Glen M. Aurdahl, Project Manager

Dear Mr. Aurdahl,

This is in reply to your December 1, 1986 letter requesting information on the use of Chandler Canal water for salmon acclimation ponds.

Water diverted into Chandler Canal is used exclusively for either irrigation purposes on the Kennewick Irrigation District or for hydropower generation at our Chandler facility. Even though the intended use for- fish acclimation might be non-consumptive any other use from this point of diversion would require a water right from the Washington Department of Ecology. In addition, if this project appears feasible, Kennewick Irrigation District would have to give their concurrence.

The existing pipeline that services the old juvenile trap is in a poor state of repair and would have to be replaced. Our present plan is to remove the old fish screen facility once the new Chandler fish screen becomes operational this spring. We would not allow the continued use of the existing pipe for an extended period because of potential damage to the Chandler Canal. If used at all, flow control to the pipeline could not be allowed except at the upstream end, since any-other regulation downstream would pressurize the pipe and worsen leakage. Also, depending on the ultimate size of the acclimation ponds, land acquisition should be considered in the overall cost to develop this site.

Because of our involvement in the planning for the Yakima Outplanting Facility we are aware of others who are contracted with the Northwest Power Planning Council to located potential sites for acclimation ponds in the Prosser area. Mr. Tom Scribner, biologist with the Yakima Indian Nation, is working on the John Day Mitigation plus the Yakima River Outplanting Facility and would be the person that you should remain in close contact with regarding acclimation pond locations in the Prosser Area.

The chandler Canal is operated continually as much as possible except for fall maintenance in October and November. Our maintenance can last for a period of two weeks to two months. Canal outages at-e sometimes necessary to repair leaks or breaks. These outages are held to a bare minimum during the irrigation season, but have, in prior instances, taken up to a week to get back on-line. No such outages of record have occurred during May but your planner's may wish to consider this possibility and explore the need for backup or emergency water sources. Because of spring runoff, the month of May is, on the average, the highest flow month of the year. Data is attached for the month of May as requested. Kennewick Irrigation District (KID) is entitled to divert a maximum of 330 cfs which, because of hydraulic pumping requirements, must be multiplied by a factor of 2.25, therefore at full entitlement this requires a canal flow of 750. One set of data attached shows that since our record keeping started there were 13 days in May, primarily 1977, that we could not meet their entitlement. When we look at actual average diversions for KID for May over the record keeping period we find that only two days in 1964 and one day in 1977 were flows less than that needed to meet KID requirements, This calculation was based on average diversion of 270 cfs X 2.25 = 625 cfs. That data is enclosed also for your use.

I hope. this information will answer the questions that you have. If you have any further questions please let us know.

Sincerely,

Ray Nelson

Harvey R. Nelson, Jr.
Project Superintendent

Enclosures

cc:
Kennewick Irrigation District (w/enclosures)
Regional Director, Attn PN 201 (w/o enclosures)

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

March 18, 1987

Washington State Department of Ecology
3601 West Washington Street
Yakima, Washington 98903

Attention: Mrs. Becky Johnson

Gentlemen:

Subject: John Day Acclimation Pond Study
Prosser Juvenile Trap Site

Sverdrup Corporation is under contract to the U.S. Fish and Wildlife Service to prepare feasibility studies for salmon acclimation facilities at sites along the Yakima and Columbia Rivers. One of the sites *being* studied is known as the Prosser Juvenile Trap Site and is located adjacent to Interstate 82, southwest of the freeway between Chandler Canal and the Yakima River.

The acclimation period for the pond at Prosser will be during the month of May each year. During that month, up to ten tanker truck loads of fish will be transferred from a hatchery to the pond for acclimation and release to the river. The water requirements for operation of the facility are estimated at ten to twenty cubic feet, per second (cfs), depending on the extent of site development. The most economical source for this water supply would be from Chandler Canal using a new pipeline from the existing canal screening structure. The water would flow by gravity to the pond and then drain through another pipeline, back to the Yakima River. For our feasibility studies we would like to know whether your agency will permit this water withdrawal from Chandler Canal during the month of May each year.

Included is a site map of our preliminary plans for the site.

Please contact us if you need additional information.

Very truly yours,

SVERDRUP CORPORATION

Glen M. Aurdahl

Glen M. Aurdahl, P.E.
Project Manager

Enclosure



cc: Bill Striplin

ANDREA BEATTY RINIKER
Director

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

3601 West Washington • Yakima, Washington 98903-1164 • (509) 575-2800

RECEIVED
APR - 2 1987
SVERDRUP CORP
SEATTLE OFFICE

March 31, 1987

Sverdrup Corporation
1200 112th Ave. N.E.
Suite C 143
P.O. Box 369
Bellevue, WA 98009

Attention: Glen M. Aurdahl

RE: Yakima River
WRIA 37

Dear Mr. Aurdahl:

Becky Johnson asked me to respond to your letter of March 18, 1987 in which you identify a potential need for Yakima River water. It is not possible for the department to prejudge a permit decision, therefor you should submit an application for the necessary water supply as soon as you can determine the quantity required.

It will not be a decision exlusively within the department's control since the use of the Chandler Canal as a conveyance will be subject to approval by the Bureau of Reclamation and the Kennewick Irrigation District. Because of the on going general adjudication case in Yakima County Superior Court, the department is not issuing water right permits. During the next several years the only option is to seek a temporary water right permit. In order for any permit decision to be made, it will be necessary for you to submit the required applications and an environmental check list. I realize your current interest is more for planning and feasibility purposes; however, there is no straight forward answer regarding water availability in the Yakima River Basin.

If I can be of any further assistance please call. Enclosed for information are application forms and SEPA check lists.

Sincerely,

Doug Clausing

Doug Clausing
Water Resource Manageme...

DC:pc

Enc.: (2) Water Right Application Forms
(2) SEPA Check Lists



PROSSER

Sverdrup
CORPORATION

1200 112th Avenue N.E.
Suite C 143
P.O. Box 369
Bellevue Washington 98009

206 454-9562

May 11, 1987

Kennewick Irrigation District
P.O. Box 6900
Kennewick, Washington 99336

Attention: Mr. Paul Chasco, Manager

Gentlemen:

Subject: Chandler Canal Water Use

Sverdrup Corporation is under contract with the U.S. Fish and Wildlife Service to prepare feasibility studies for salmon acclimation facilities at sites along the Yakima and Columbia Rivers. One location being studied is near the old Prosser Juvenile Trap between Chandler Canal and the Yakima River, adjacent on the southeast to Interstate 82.

The propcsal at this site is to use 10 to 20 cfs from Chandler Canal during May each year to raise chinook salmon fry. These fry would be brought to the facility in tank trucks, fed in ponds for one month and then released into the river. The facility would also include a capture, holding and spawning structure for returning adult salmon. This would required 5 to 10 cfs for approximately 75 days between mid October and the end of November. It may be possible to do adult capture elsewhere if this flow is not available.

The purpose of this letter is to ask if the Kennewick Irrigation District would al low use of up to 20 cfs during May and up to 10 cfs for 2-1/2 months each fall. We have previously contacted the Bureau of Reclamation and the Washington Department of Ecology to inquire about this water use. Copies of our correspondence and their replys are enclosed.

As you will see, both agencies were unable to give a direct answer. The Department of Ecology states that there is pending litigation concerning Yakima River water rights and that, at best, only a temporary permit could be issued. The Bureau stated that permission from the District is necessary and that you have a 750 cfs entitlement. From data they provided it appears the minimum canal flow during May on five occasions between 1960 and 1986 was less than this amount. A copy of their data is also enclosed. We did not request similar flow information for October and November.

Mr. Paul Chasco
Kennewick Irrigation District
Page 2 May 11, 1987

Please let me know if you desire any clarification on this request. Thank you for your assistance.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P. E.

cc: Bill Striplin, USF&W

REC'D 6/1 HTA
PROSSER

Kennewick Irrigation District
P. O. Box 6900
*Kennewick,*Washington993364401
Telephone (509) 586-91 I I
2 12-2 I4 West First Avenue

May 28, 1987

Harold T. Anderson, PE
Sverdrup Corporation
P.O. Box 369
Bellevue, WA 98009

RE: Chandler Canal Water Diversion

Dear Mr. Anderson,

Thank you for your letter of May 11, 1987 regarding construction of a salmon out planting facility at the former Prosser juvenile trap site. The project goals are certainly admirable and fit nicely with the Columbia River Mainstem Mitigation Plan. Upon review of this site there appears to be a number of stumbling blocks. I would recommend the second alternative involving the Prosser Dam right bank fish ladder be utilized. There is an existing contractual 15 cfs instream flow minimum established which the right bank ladder could utilize. This alternative avoids the Yakima River Acquevella Adjudication proceedings, the power subordination issues and the sensitive issue of Chandler diversions.

In view of this better alternative the KID is unable to agree to any diversions from the Chandler Canal for this use. should you have further questions or comments please feel free to contact me at your convenience.

Sincerely,

KENNEWICK IRRIGATION DISTRICT

Paul Chasco

Paul Chasco
Secretary-Manager

PC:vgz
cc: Ray Nelson, USBR

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 19, 1987

Benton County P.U.D.
P.O. Box 6270
Kennewick, WA 99336

Attention: Mr. Randy Gregg

Gentlemen:

Subject: Power Service
Prosser Acclimation Facility

This is to inquire about the availablity and cost for power service to a site which is adjacent to the Yakima River and Interstate Highway 82 near Prosser, Washington. The precise location is shown on the enclosed drawing.

Sverdrup is preforming a chinook salmon fry rearing feasibility study for the U.S. Fish and Wildlife and this site is one of several being considered. The power requirement is approximately 3 horsepower for a fish food freezer and probably a 200 amp service for a residence and low level outdoor lighting. This facility would only operate during May and for six to eight weeks in October and November.

At your earliest convenience please send me a letter that gives an approximate cost for providing this electric service. Also please include your power rates so that we can estimate opertional costs.

Please let me know if you have questions. Thank you for your assistance.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosure

REC'D 6/1 HTA
PROSSER

PUBLIC POWER

LOCAL CONTROL

524 South Auburn Street
P. O. Box 6270
Kennewick, Washington 99336
(509) 582-2175

**Public Utility District No. 1 of Benton Co. Washington**

May 28, 1987

Mr. Harold T. Anderson, P.E.
Sverdrup Corporation
P. O. Box 369
Bellevue, WA 98009

Dear Mr. Anderson:

Per your request enclosed is the cost estimate to furnish power to the Prosser Acclimation Facility. Also as requested is the District's rate schedule for your application.

If you have any questions please feel free to contact this office.

Very truly yours,

Gene W. Floyd

Gene W. Floyd
Field Engineer

GWF:tah

Enclosures

# SCHEDULE 2

## GENERAL SERVICE

AVAILABLE: In all territory served by the District in Benton County.

APPLICABLE: To commercial, industrial, public buildings, and other services not eligible under other rate schedules.

CHARACTER OF SERVICE: Sixty hertz alternating current of such phase and voltage as the District may have available.

RATE: Monthly Customer Charge:
Single-phase......................$7.50
Multi-phase......................$11.25

Monthly Energy Charge:
March 21 through August 20, inclusive:
First 3,500 kwh @............2.91¢ per kwh
Next 16,500 kwh @............2.50¢ per kwh
Over 20,000 kwh @............1.73¢ per kwh

August 21 through March 20, inclusive:
First 3,500 kwh @............3.35¢ per kwh
Next 16,500 kwh @............2.90¢ per kwh
Over 20,000 kwh @............1.85¢ per kwh

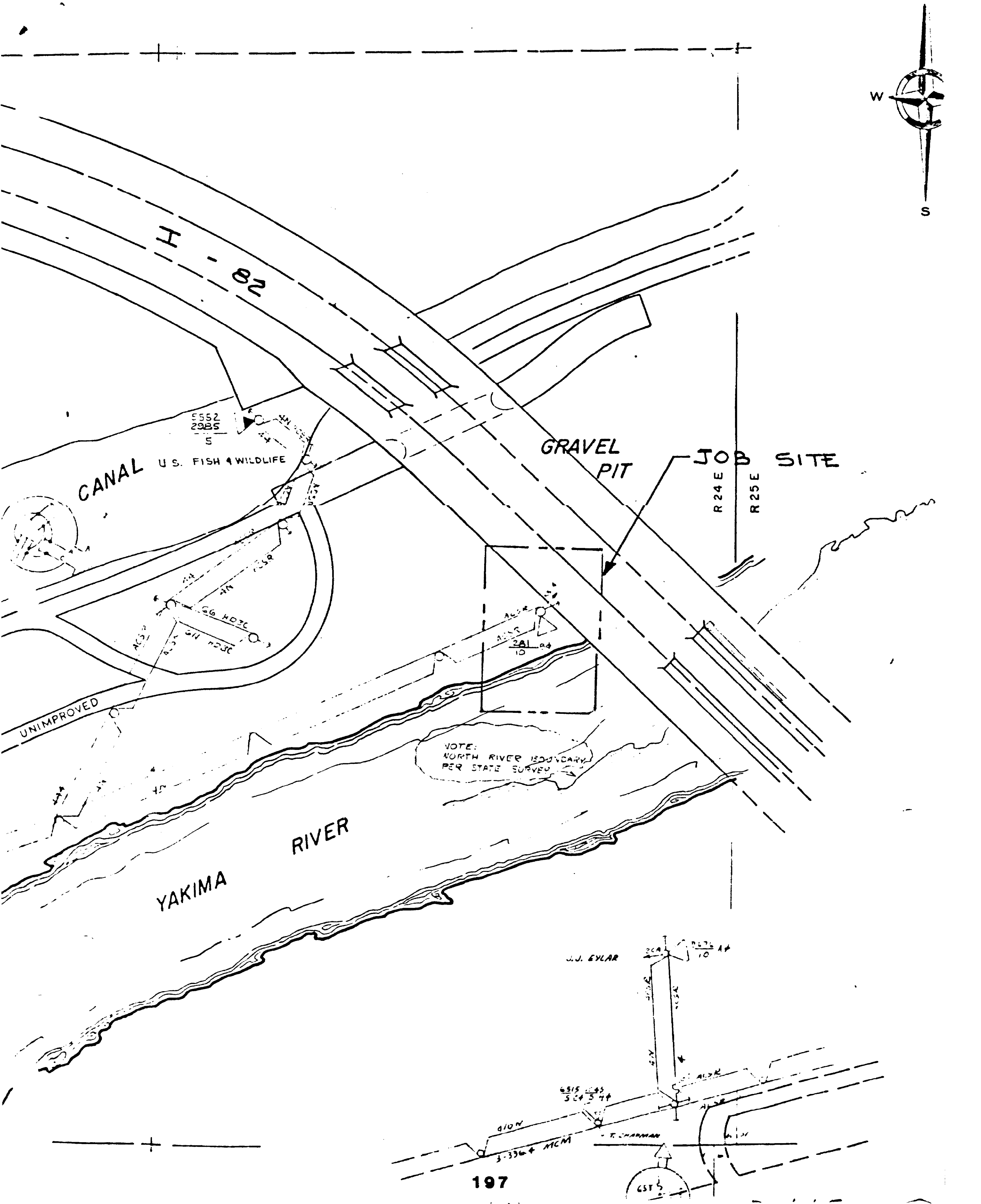
DEMAND CHARGE: First 50 kw of demand per month - no demand charge. Excess above 50 kw of demand per month for bills issued from:

April 21 through November 20, inclusive, $0.62 per kilowatt billing demand per billing period; plus $2.48 per kilowatt billing demand per billing period for demand created Monday through Saturday, 7:00 a.m. to 10:00 p.m.

The demand charge for demands created at non-time-of-day metered services shall be $3.10 per kilowatt billing demand per billing period.

November 21 through April 20, inclusive, $0.62 per kilowatt billing demand per billing period plus $4.34 per kilowatt billing demand per billing period for demand created Monday through Saturday, 7:00 a.m. to 10:00 p.m.

The demand charge for demands created at non-time-of-day metered services shall be $4.96



W
S
I - 82
GRAVEL
PIT
JOB SITE
R24E
R25E
CANAL
U.S. FISH & WILDLIFE
UNIMPROVED
NOTE:
NORTH RIVER BOUNDARY
PER STATE SURVEY
YAKIMA
RIVER
J.J. EYLAR
3-336.4 MCM

PROSSER ACCT...

# WORK ORDER ESTIMATE SHEET

| QUANTITY | DESCRIPTION | UNIT COST | COST |
|---|---|---|---|
| 1 | 25'/7 METER POLE | 527 | 527 |
| 1 | OVERHEAD SERVICE | 323 | 323 |
| | CHANGE OUT TRANSFORMER | 250 | 250 |
| | | | $1100 |

Sverdrup
CORPORATION

12[illegible] 112th Avenue N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 22, 1987

United Telephone Company
601 State Street
Hood River, Oregon 97031

Attention: Ms. Liz Moore, MS63

Subject: Prosser & Sunnside Acclimation Facilities

Dear Ms. Moore,

This is to inquire about the availablity and cost for telephone service to two sites. One is adjacent to the Yakima River and Interstate Highway 82 near Prosser, Washington. The other is at Sunnyside Dam on the Yakima River near the community of Parker, Washington. Locations are shown on the enclosed drawings. Both sites are undeveloped and to my knowledge there are no telephone lines nearby.

Sverdrup is preforming a chinook salmon fry rearing feasibility study for the U.S. Fish and Wildlife Service and these sites are two of several being considered. There will be housing for the facility manager and the need is for a residential hook up only. Fry rearing will occur during May and adult capture and spawning will last six to eight weeks in October and November. These are the only times the sites will be used.

At your earliest convenience please send me a letter that gives an approximate cost for providing this telephone service.

Please let me know if you have questions. Thank you for your assistance.

Very truly yours,

SVERDURP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosure

United Telephone System

United Telephone of the Northwest
601 State Street l Hood River. Oregon 97031

June 4, 1.987

Harold T. Andersen, PE
Sverdrup Corporation
1200 112th Avenue NE
P 0 Box 369
Bellevue, Washington 98009

Dear Mr. Anderson: PROSSER + SUNNYSIDE

Reference is made to your letter of May 22, 1987. From the maps provided, it would appear that service can be provided to both sites at no additional cost other than basic line connection charges ($25.00). However, our engineer in Sunnyside informs me that without surveying the actual location this is an assumption at best.

Should a line extension become necessary, the following applies:

> we will extend a line 528 feet (l/lOth mile) on a public road at no charge
>
> we will extend a line 120 feet on a private road at no charge
>
> a charge of $1.00 per foot will apply for distances beyond the above

I might suggest that you contact our office in advance of placing an order for service. Our facility technician can arrange to meet you at these locations and can determine at that time if a line extension would be necessary. We need at least one weeks' notice and arrangements can be made by calling out business office at 503 387-6904.

If I can be of further assistance, please call me at the above number.

Sincerely,

Liz Moore

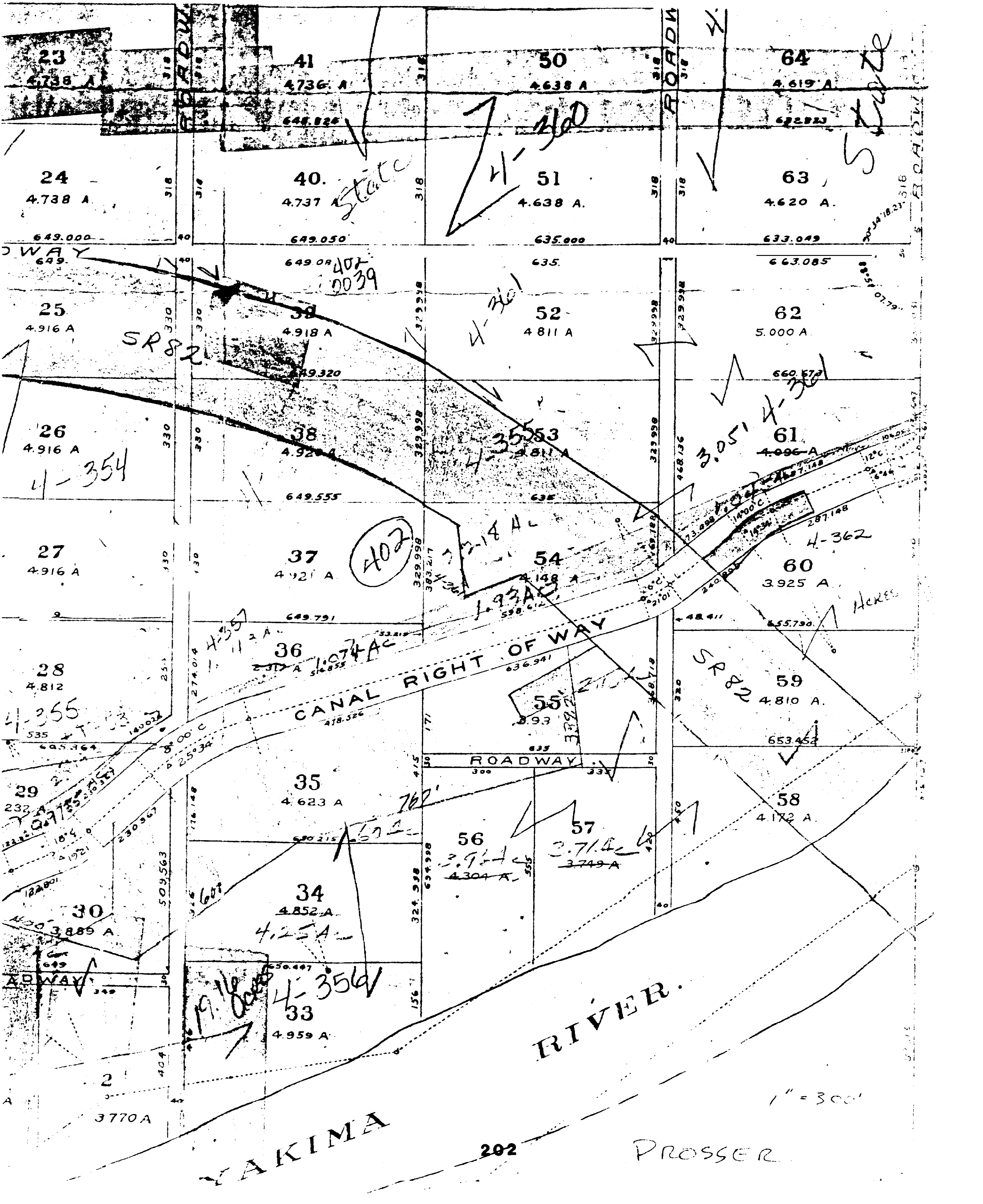
Liz Moore
Service Representative

:em

RECEIVED
JUN - 8 1987
SVERDRUP CORP.
SEATTLE OFFICE

APPENDIX B

LAND OWNERSHIP INFORMATION



23
4.738 A
41
4.736 A
50
4.638 A
64
4.619 A
24
4.738 A
40.
4.737 A
51
4.638 A.
63
4.620 A.
649.000
649.050
635.000
633.049
25
4.916 A
39
4.918 A
52
4.811 A
62
5.000 A
SR82
26
4.916 A
38
53
4.811 A
61
4-354
649.555
27
4.916 A
37
4.921 A
54
4.148 A
60
3.925 A
402
4-362
CANAL RIGHT OF WAY
36
28
4.812
59
4.810 A.
SR82
4-355
55
3.93
ROADWAY
29
35
4.623 A
58
4.172 A
56
4.304 A
57
3.749 A
34
4.852 A
4.25 A
30
3.889 A
ROADWAY
33
4.959 A
4-356
2
3770 A
YAKIMA RIVER.
1" = 300'
202
PROSSER

ROLL 4 | PAGE 226
DESCRIPTION NUMBER

3694-402-0030-000

# BENTON COUNTY ASSESSMENT RECORD

ACRES ~~7.63~~ | TAX LOT NUMBER 31

ADDITION: State Addition to City of Prosser #1

BLOCK | LOT | SECION 36 | TWP. 9 | RANGE 24

PROPERTY ADDRESS:

SUB-DIVISION:
Tract 30, less canal r/w - Less ptn daf:
Tracts 31, 32, and 33.
Tract 34, less canal r/w
Tract 35, less canal r/w

TAXING DISTRICTS

| CITY | ROAD | SCHOOL | HOSPITAL | FIRE | LIBRARY | WATER | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 116 | P | #3 | R | SV | 1959 PB | M |

LEGAL DESCRIPTION

Less a ptn of th SW¼ SE¼ & is th ptn of Lot 31 daf: TPOB of sd parcel is th S¼ crn of sd Sec. Th N 00°34'20" E 671.44' on th mid-sec ln of sd Sec. Th N 89°58'39" E 300' on th center ln of Platted St & is th N bndry of sd Lot 31; Th S 00°34'20" W 672.71' on th E bndry of sd Lot 31; Th N 89°46'44" W 300' on th S bndry of sd Sec 36 to th TPOB of sd parcel. (Deeded 7/31/86 #86-11404) Chandler Canal R/W

Less th ptn of Lot 30 from State Add to Prosser daf: Bae S¼ crn of sd Sec. Th N 00°34'20" E 671.44' on th mid-sec ln of sd Sec. to th TPOB of sd parcel. Th conting on sd bearing N 00°34'20" E 13.19' on th W bndry of sd Lot 30. Th N 55°20'00" E .36' on th centerln of Chandler Canal. Th on centerln of Chandler Canal on a curve tha arc's right 550'. w a radius . Th S 00°34'20" W 240'; Th S 60°33'18" W 217.89'. Th S 00°34'20" W 70'; Th S 89°58'39" W 300'. on th centerln of Platted St. & th S bndry of sd Lot 30. to th TPOB of sd parcel.
(Deeded 7/31/86 #86-11404) Chandler Canal R/W
Reserv Easmt for Access to water

203

| KIND OF SALE | AMOUNT OF SALE | 613M OWNER'S NAME | MO. | DAY | YR. | YEAR | LAND | IMP. | TOTAL ASSESSED VALUE | 81C REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F. Gerald Johnson | 12 | 3 | 52 | 1953 | 180 | | 180 | |
| WD | 120.00 with 362 45-172 & 49-235 | Albert M. Kraft & Dorothy I. | 2 | 24 | 71 | 1955 | 170 | | 170 | |
| | | | | | | 1957 | 140 | | 140 | |
| | | | | | | [illegible] | [illegible] | | [illegible] | |
| | | | | | | 1970 4 356 | 300 | | 300 | |
| | | | | | | 1971 | 380 | | 380 | |
| | | | | | | 1972 | 1530 | | 1530 | |
| | | | | | | 4 356 1974 | 6120 | | 6120 | |
| | | | | | | 4 356 | | | | |

ROLL 4 | PAGE ~~177~~

DESCRIPTION NUMBER

PARCEL # 3694-402-0055-000

# BENTON COUNTY ASSESSMENT RECORD

~~24.89~~ ACRES | TAX LOT NUMBER

ADDITION: State Addition to City of Prosser #1

BLOCK | LOT | SECTION 36 | TWP. 9 | RANGE 24

PROPERTY ADDRESS:

SUB-DIVISION:

Tracts 55, 56, 57, 58, 59 and 60

Less KID r/w

Less 5.59 Ac for SR 82 2-11-76

Rep. Esmt. 2-11-76

| CITY | ROAD | SCHOOL | HOSPITAL | FIRE | LIBRARY | WATER | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 116 | P | #3 | R | SV | 1959 PB | M |

1613 M

| KIND OF SALE | AMOUNT OF SALE | OWNER'S NAME | MO. | DAY | YR. | YEAR | LAND | IMP. | TOTAL ASSESSED VALUE | 81B REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| QCD | | F. Gerald Johnson | 12 | 3 | 52 | 1953 | 180 | | 180 | |
| WD | see 356. | Albert M. Kraft + Dorothy J. | 2 | 24 | 71 | [illegible] | 170 | | 170 | |
| | | | | | | [illegible] | [illegible] | | [illegible] | |
| | | | | | | 1970 | 380 | | 380 | |
| | | | | | | 4 362 | | | | |
| | | | | | | 1971 | 630 | | 630 | |
| | | | | | | 1972 | 1690 | | 1690 | |
| | | | | | | 4 362 | | | | |
| | | | | | | 1974 | ~~4430~~ 3290 | | ~~4430~~ 329 | Cancel plus [illegible] SR82 #1 2/17/77 |
| | | | | | | 1976 | ~~4430~~ 3040 | | ~~4430~~ 3040 | 26+27 [illegible] |
| | | | | | | 4 362 | | | | |
| | | | | | | 1979 | 17090 | | 17090 | |
| | | | | | | 4 362 | | | | |
| | | | | | | 83 R | 20510 | | 20510 | |
| | | | | | | 1-3694-402-0055-000 | | | | |
| | | | | | | 86 R | 17430 | | 17430 | |

204

# APPENDIX C

## FLOW RECORDS, FLOOD PREDICTIONS

United States Department of the Interior

BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
FEDERAL BUILDING & U.S. COURTHOUSE
BOX 043-550 WEST FORT STREET
BOISE, IDAHO 83724

IN REPLY
REFER TO: PN 769

NOV 6 1986

Arnold Marquez
Sverdrup Corporation
P.O. Box 369
Bellevue, Washington 98009

Dear Mr. Marquez:

Enclosed are the hydrographs and rating curves for various locations on the Yakima River which you requested by telephone on October 31. We hope that they are helpful to you in your analysis of habitat areas.

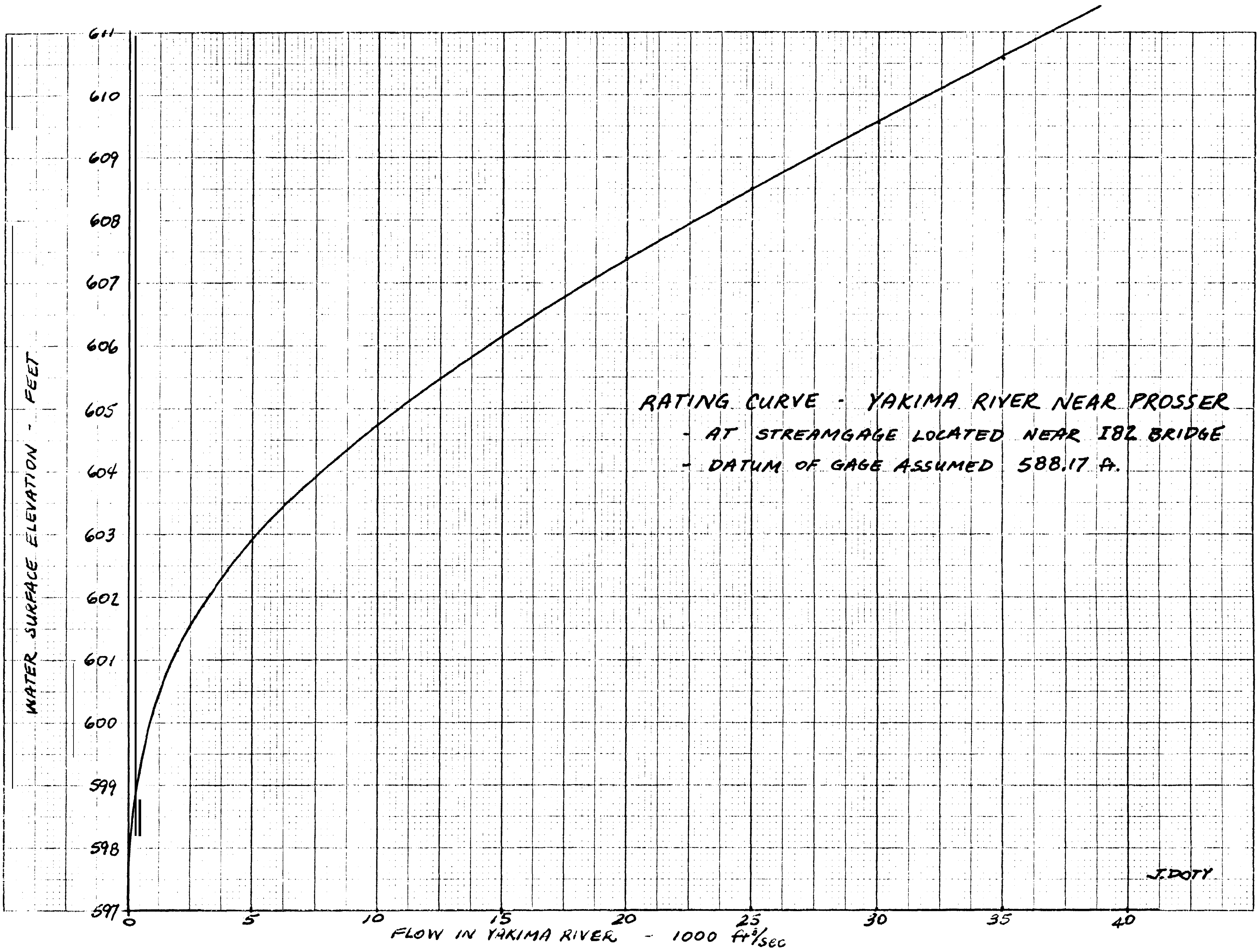
If you have any questions, please contact Jim Doty of our office at (208) 334-1339.

Sincerely yours,

Robert J. Riley
Acting Regional Planning Officer

Enclosures

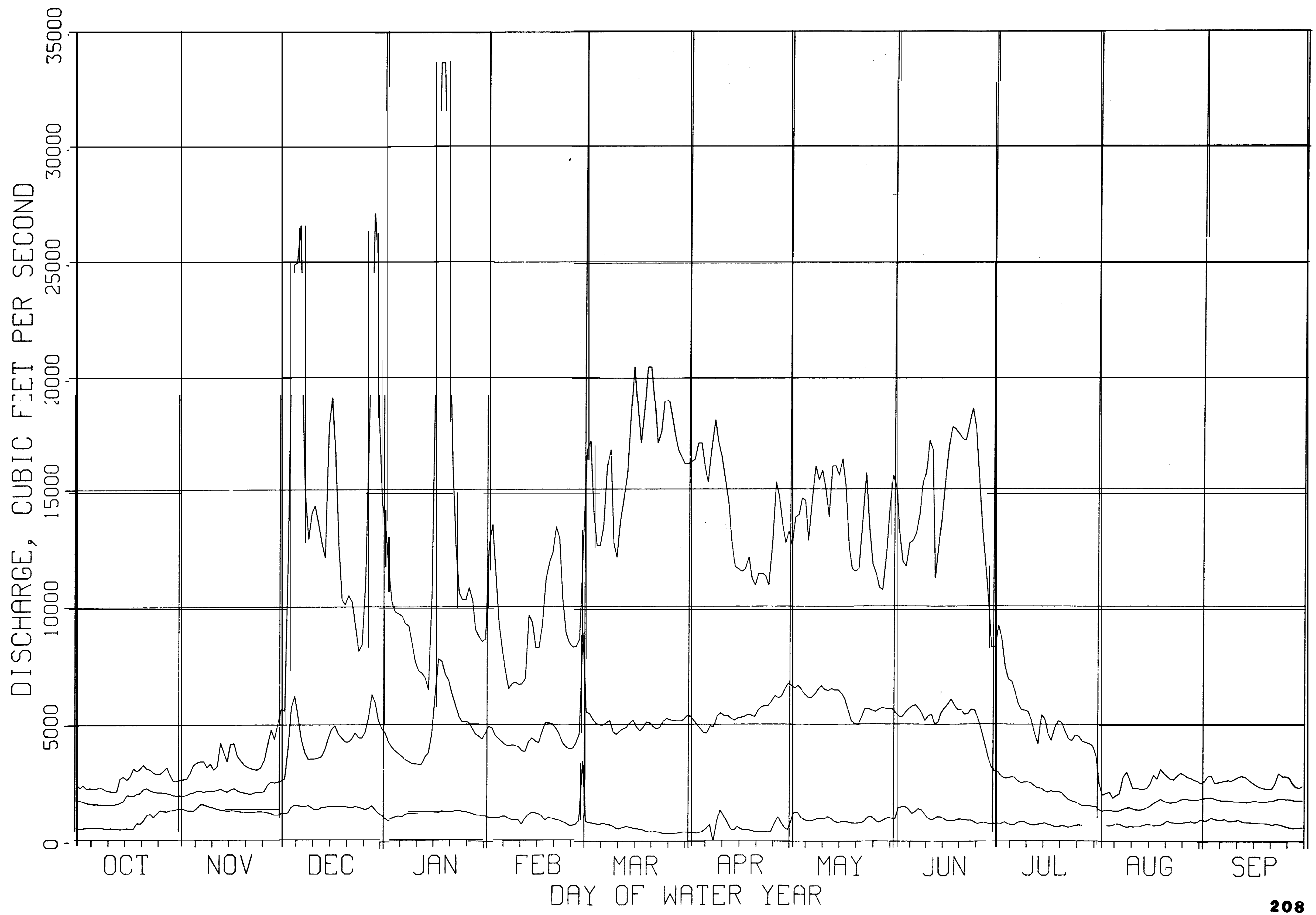
RECEIVED
NOV 10 1986
SVERDRUP & PARCEL
& ASSOCIATES INC.


RATING CURVE - YAKIMA RIVER NEAR PROSSER
- AT STREAMGAGE LOCATED NEAR I82 BRIDGE
- DATUM OF GAGE ASSUMED 588.17 ft.
WATER SURFACE ELEVATION - FEET
611
610
609
608
607
606
605
604
603
602
601
600
599
598
597
0
5
10
15
20
25
30
35
40
FLOW IN YAKIMA RIVER - 1000 ft³/sec
J. DOTY

# YAKIMA RIVER AT MABTON, WA. (1971-1981)

(ABOVE PROSSER DAM)

MEAN, MINIMUM AND MAXIMUM



## KEY TO MAP

500-Year Flood Boundary

100-Year Flood Boundary

FLOODWAY FRINGE — FLOODWAY

100-Year Flood Boundary

500-Year Flood Boundary

Approximate 100-Year Flood Boundary

Cross Section Line — A — A

Elevation Reference Mark — RM7 ×

River Mile — • M1.5

### NOTES TO USER

**Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.**

**This map was prepared to facilitate flood plain management activities only; it may not show all special flood hazard areas in the community or all planimctric features outside of the flood plain. Refer to the latest official Flood Insurance Rate Map for any additional areas of special fiood hazard.**

**Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at I/20 inch.**

**For adjoining map panels, see separately printed Index to Map Pane is.**

**PANEL 485 OF 1075**

**(SEE MAP INDEX FOR PANELS NOT PRINTED)**

**COMMUNITY-PANEL NUMBER**
**530237 0485**

**EFFECTIVE DATE:**
**JULY 19, 1982**

Federal Emergency Management Agency

PROSSER JUVENILE TRAP

APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

# FLOODWAY

## FLOOD BOUNDARY AND FLOODWAY MAP

## BENTON COUNTY, WASHINGTON

(UNINCORPORATED AREAS)

**PANEL 505 OF 1075**

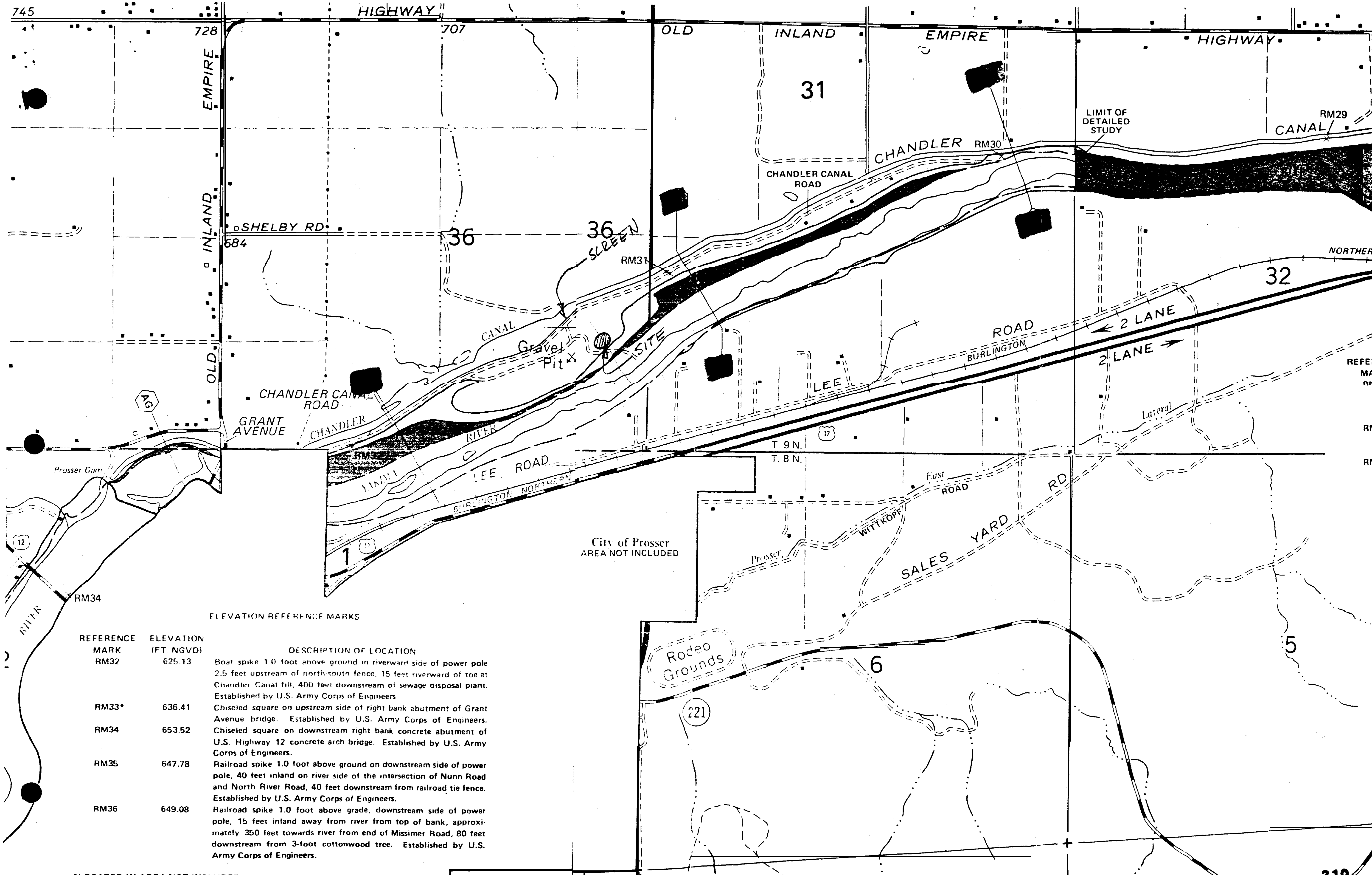
(SEE MAP INDEX FOR PANELS NOT PRINTED)

**COMMUNITY-PANEL NUMBER**
**530237 0505**

**EFFECTIVE DATE:**
**JULY 19, 1982**

Federal Emergency Management Agency

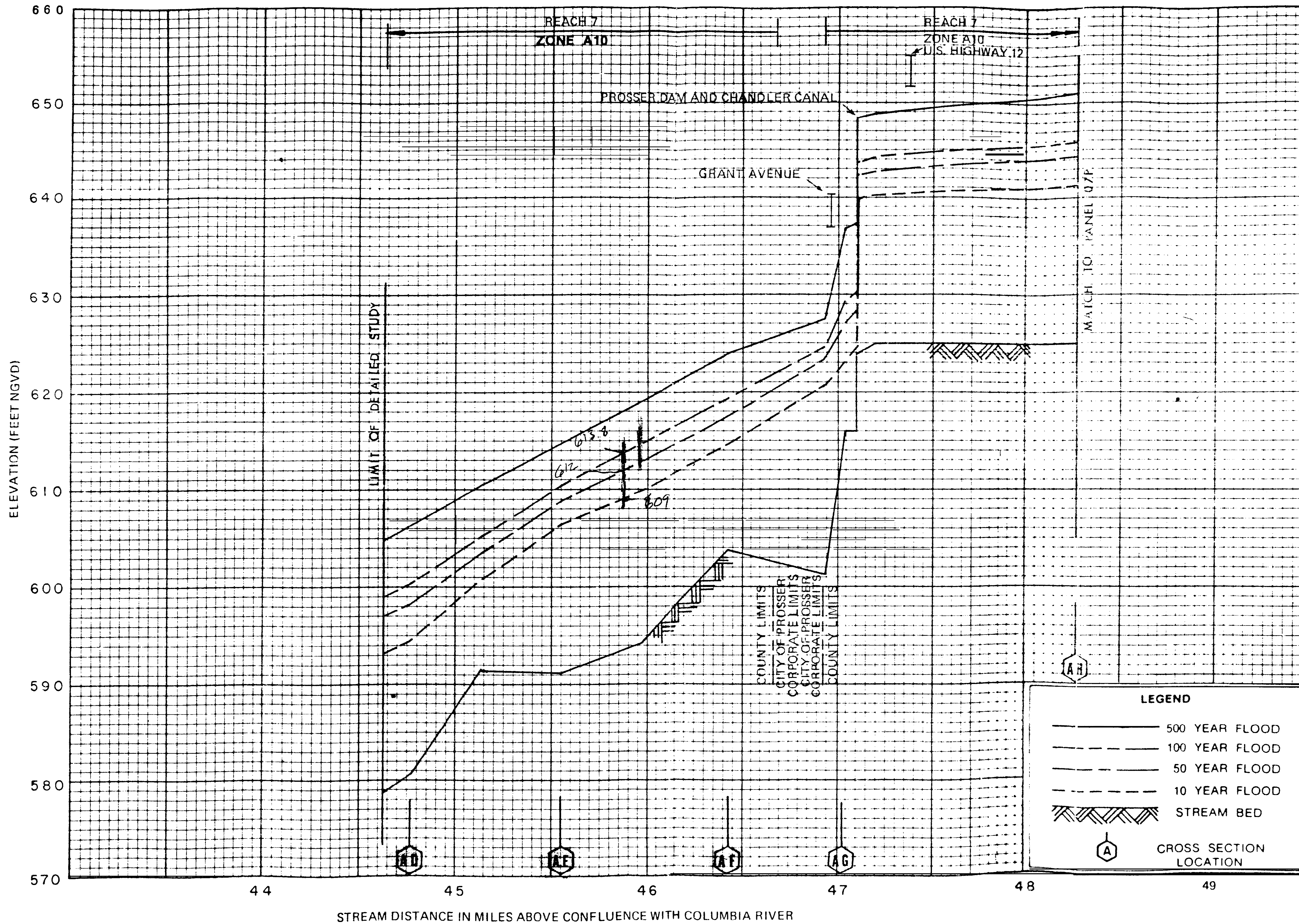
PROSSER JUVENILE TRAP




FLEVATION REFERENCE MARKS

| REFERENCE MARK | ELEVATION (FT. NGVD) | DESCRIPTION OF LOCATION |
|---|---|---|
| RM32 | 625.13 | Boat spike 1.0 foot above ground in riverward side of power pole 2.5 feet upstream of north-south fence, 15 feet riverward of toe at Chandler Canal fill, 400 feet downstream of sewage disposal plant. Established by U.S. Army Corps of Engineers. |
| RM33* | 636.41 | Chiseled square on upstream side of right bank abutment of Grant Avenue bridge. Established by U.S. Army Corps of Engineers. |
| RM34 | 653.52 | Chiseled square on downstream right bank concrete abutment of U.S. Highway 12 concrete arch bridge. Established by U.S. Army Corps of Engineers. |
| RM35 | 647.78 | Railroad spike 1.0 foot above ground on downstream side of power pole, 40 feet inland on river side of the intersection of Nunn Road and North River Road, 40 feet downstream from railroad tie fence. Established by U.S. Army Corps of Engineers. |
| RM36 | 649.08 | Railroad spike 1.0 foot above grade, downstream side of power pole, 15 feet inland away from river from top of bank, approximately 350 feet towards river from end of Missimer Road, 80 feet downstream from 3-foot cottonwood tree. Established by U.S. Army Corps of Engineers. |

*LOCATED IN AREA NOT INCLUDED

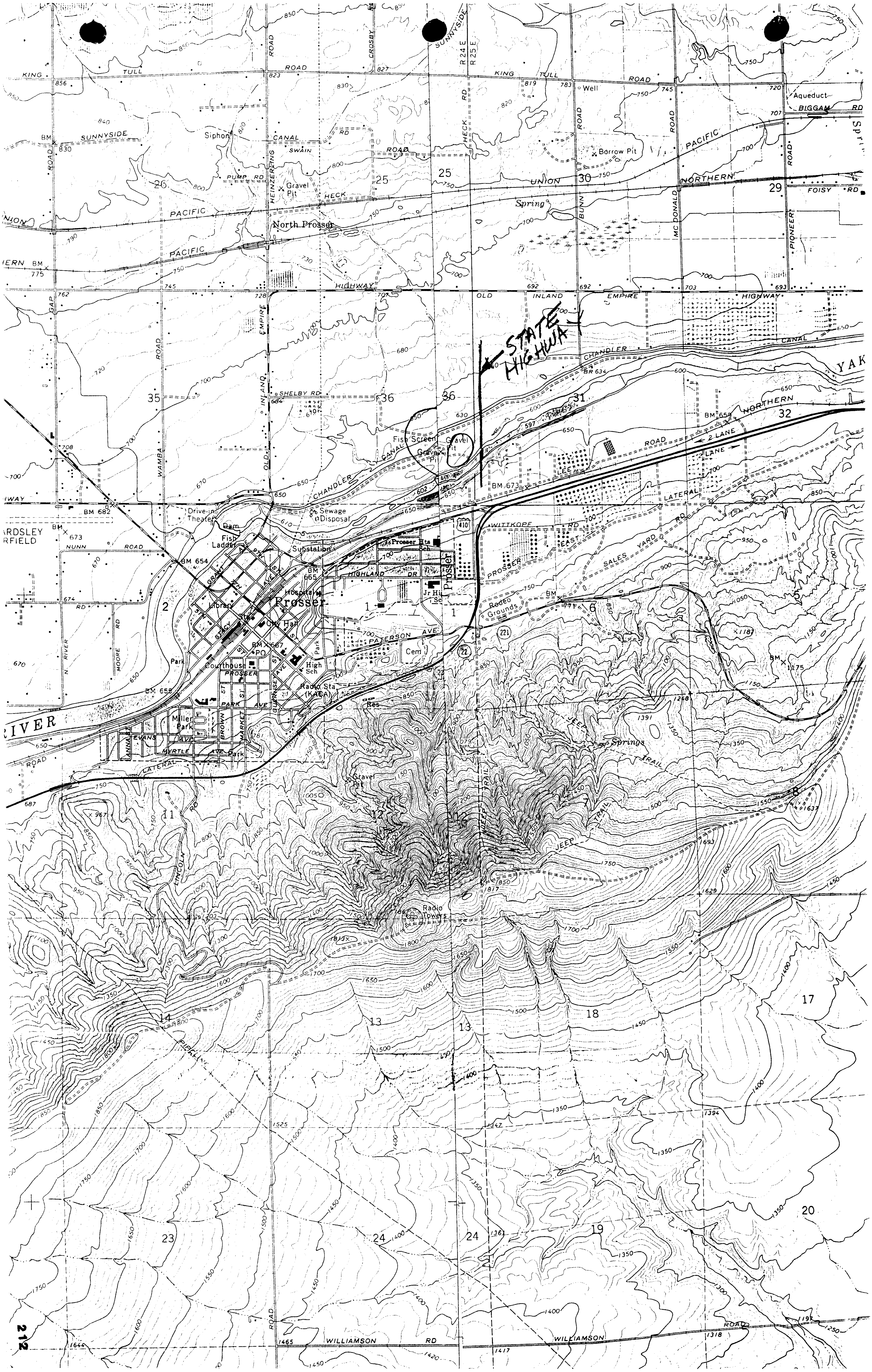



# FLOOD PROFILES

## YAKIMA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
**BENTON COUNTY, WA**
(UNINCORPORATED AREAS)

**06P**


STATE HIGHWAY
Prosser
North Prosser
KING TULL ROAD
SUNNYSIDE CANAL
UNION PACIFIC
NORTHERN PACIFIC
OLD INLAND EMPIRE HIGHWAY
CHANDLER CANAL
YAK
RIVER
HEINZERLING ROAD
HECK RD
BUNN ROAD
MC DONALD ROAD
PIONEER ROAD
BIGGAM RD
FOISY RD
GAP ROAD
WAMBA ROAD
SHELBY RD
N RIVER RD
MOORE RD
NUNN ROAD
WITTKOPF RD
PROSSER EAST SALES YARD RD
PATERSON AVE
LATERAL
JEEP TRAIL
WILLIAMSON RD
Hospital
Library
City Hall
Courthouse
High Sch
Radio Sta (KACA)
Jr Hi Sch
Cem
Rodeo Grounds
Sewage Disposal
Substation
Drive-in Theater
Dam
Fish Ladder
Fish Screen
Gravel Pit
Borrow Pit
Siphon
Spring
Springs
Well
Aqueduct
Radio Towers
Miller Park
Park
Res
R 24 E
R 25 E
2 LANE
PIPELINE

# APPENDIX D

# WATER QUALITY RESULTS

am test inc.

14603 N.E. 87th St. l REDMOND, WASHINGTON 98052 * 2061885-1664

# ANALYSIS REPORT

CLIENT: Sverdrup Corporation

DATE RECEIVED: 5/6/87 (704887)
5/5/87 (704874-876)

REPORT TO: Gary Wiggins
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 5/26/87

| Laboratory Sample Number | 704874 | 704875 | 704876 | 704877 |
|---|---|---|---|---|
| Client Identification | Ringold Spring | Ringold W W | Prosser | Walla Walla |
| Alkalinity (mg/l as $CaCO_3$) | 228. | 169. | 50. | 254. |
| Ammonia (mg/l) | 0.018 ]<br>0.017 | 0.059 | 0.054 | 0.077 |
| Chloride (mg/l) | 27. | 16. | <1.0 | 11. |
| Dissolved Oxygen (mg/l) | 15.1 | 9.9 | 12.5 | 11.4 |
| Nitrate & Nitrite (mg/l) | 4.30 | 2.41 | 0.440 | 0.97 |
| Nitrite (mg/l) | <0.002 | 0.019 ]<br>0.019 | 0.011 | 0.011 |
| Total Suspended Solids (ma/l) | 3. | 32. | 107. | 12. |
| Settleable Solids (mg/l) | <0.l | 0.1 | 0.7 | <0.1 |
| Copper (mg/l) | 0.003 | 0.002 | 0.003 | 0.002 |
| Zinc (mg/1) | 0.033 | 0.042 | 0.065 | 0.028 |

] - indicates duplicate analysis.

REPORTED BY John T. Dailey
John T. Dailey

JTD:vb

am test inc.
14603 N.E. 87th • REDMOND, WASHINGTON 98053 • 206/885-1664

# ANALYSIS REPORT

CLIENT: Sverdrup

DATE RECEIVED: 5/27/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED 5/31/87

| Laboratory Sample Nos. | Client Identification | Total Kjeldahl Nitrogen (mg/l) | Total Dissolved Solids (mg/l) | PH |
|---|---|---|---|---|
| 704320 | 3 Mile Canyon | 0.272 | 145. | 8.0 |
| 704321 | Willow Creek | 0.300 | 168. | 8.1 |
| 704322 | Hat Rock | co.20<br>co.201 | 611. | 8.0<br>8.11 |
| 704874 | Ringold Spr. | co.20 | 506. | 8.0 |
| 704875 | Ringold WW | 0.438 | 371. | 8.5 |
| 704876 | Prosser | 0..388 | 220. | 7.4 ok |
| 704887 | Walla Walla | 0.355 | 398. | 8.0 |

REPORTED BY
John Dailey

JD/pb

# JOHN DAY FALL CHINOOK/SALMON MITIGATION PLAN
# ACCLIMATION AND IMPRINTING
# SITE FEASIBILITY STUDY
# WHITE BLUFFS SITE

Completion Report

by

U.S. FISH AND WILDLIFE SERVICE
Portland, Oregon

and

SVERDRUP CORPORATION
Bellevue, Washington

Funded by

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
DIVISION OF FISH AND WILDLIFE
CONTRACT NO. 14-16-0001-84078
PROJECT NO. ________

September 1987

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## APPENDICES

# I INTRODUCTION

White Bluffs Ferry is one of 10 locations being considered for an acclimation facility as part of the John Day Fall Chinook Salmon Mitigation Plan. This report presents results from an engineering feasibility study of the White Bluffs site.

# II SITE INFORMATION

## A. Location

White Bluffs Ferry is on the northeast Columbia River shore in Franklin County, Washington, approximately 22 road miles southeast of Vantage, Washington. The site is in Sections 28 and 29, Township I4 North, Range 27 East at Columbia River mile 370. Figure 1 is a Location Map and Figure 2 is a Vicinity Map for the White Bluffs site.

## B. Land Ownership

All land at White Bluffs is owned by the United States Government, Department of Energy, and is within the Hanford Nuclear Reservation boundaries. This area is also part of Wahluke State Wildlife Recreation Area, which is managed by the Washington Department of Game (WDG). Recreational use by the public is limited to daylight hours only. The portion of Hanford with highly restricted access is across the river. The U.S. Bureau of Reclamation owns and maintains an irrigation water runoff ditch and the Bonneville Power Administration has high voltage powerlines, both of which cross the site.

## C. Site Description

White Bluffs is on the northeast shore of the Columbia River at the site of an old ferry crossing. The ferry landing, a wide concrete ramp into the river, is currently used for boat launching. The road onto the site is paved but narrow, An irrigation wasteway (rock-lined open channel) crosses the road before discharging its water into a swampy area adjacent to a river backwater. It is reported that the wasteway has perennial flow. U.S. Geological Survey gauging records are provided in Appendix B. The backwater is on the east side of the site. At periods of low river flow it appears to be nearly cut off from the river. A second backwater is on the west side. It is much smaller, but appears to be open to the river at all flow stages. This small backwater seems to receive the majority overland flow from the wasteway. Near the large backwater, springs appear in marshy areas. They could be from wasteway flow or from natural ground water. High voltage electric power transmission lines cross the river just south of the project site. Fairly recent gravel extraction has occurred at two or more locations on site. On May 19, 1987, there was a large number of fish (probably carp) present in both backwater ponds.

## D. Access and Services

Access to the White Bluffs site is good. There are mostly paved roads to within 300 feet of potential building sites. The area is 9 miles southwest of Othello, Washington on Highway 24, and 22 miles southeast of Vantage, Washington on Highways 24 and 243. To reach the site from Vantage or Yakima, travel 9.3 miles east on Highway 24 from the Highway 241-243 junction near Vernita Bridge.

Turn south onto the Wahluke Wildlife Refuge and travel 3.8 miles on an unpaved, then paved, road. Turn east and go another 0.7 mile. This is a remote location and the nearest services are in Othello.

E. Soils and Vegetation

Soils in the project area generally appear to be permeable sandy loam over occasional alluvial deposits of rounded gravel. Along the backwaters and in the marshy area formed by the irrigation wasteway, the soil is much finer grained and less permeable. There is no surficial evidence of bedrock in the project vicinity. Most soil in the area is suitable for supporting structures. The USDA Soil Conservation Service has not cataloged the White Bluffs area, Vegetation consists mostly of grasses and sage. There are some large trees at the upper end of the east backwater.

F. Flood Levels

The Columbia River at White Bluffs is free flowing but subject to regulation by upstream dams. The U.S. Department of the Army, Seattle District Corps of Engineers, has predicted 100-year recurrence interval flood levels upstream and downstream from this location. At river miles 351 and 388 the elevations are 363 and 415, respectively. (Refer to correspondence in Appendix A.) Interpolation for White Bluffs at river mile 370 indicates a 100-year flood level at elevation 390. This is below elevations planned for critical fisheries facilities.

## G. Utilities

White Bluffs is in the service areas of PUD No. 1 of Franklin County and Telephone Utilities of Washington. These companies are headquartered in Pasco and Cheney, Washington, respectively. There are no telephone or useable powerlines nearby, but both companies have been contacted and have provided cost estimates for extending service to the site. Because of the remote location the cost of utility service is very high. Therefore, it is recommended that on-site power generation and radio communications be used. Refer to the cost summary in Table 1 and the correspondence in Appendix A.

## H. Cultural Resources

The White Bluffs area has been used by Native Americans since approximately 10,000 years ago up to historic times when white pioneers and settlers arrived. Therefore, it is quite likely there are cultural resources that could be disturbed by construction. Detailed archaeological investigations should be conducted in conjunction with design work, and a professional archaeologist should monitor construction (refer to the Cultural Resource Overview report in the Summary Report).

## III PRODUCTION GOALS

Production at any fisheries facility is primarily limited by the quantities of water available. At White Bluffs, most or all water will be pumped and the quantity used for estimating production was 15 cubic feet per second (cfs). This is the same flow as at the Oregon and Walla Walla sites, where pumping is also necessary. This rate was used so that equal comparisons between sites could be made.

With 15 cfs flow it would be possible to rear 30,000 pounds of fry or smolts in four 7,500-pound lots. There would be 0-, 7-, 14- and 21-day acclimation periods for each lot of fish to allow experimentation with the acclimation and imprinting success. In addition, the facility is planned so that different rearing programs can be used if desired.

## IV DEVELOPMENT CONCEPTS

At White Bluffs both a land based and a floating facility appear feasible. The land based site could have either concrete raceways or asphalt lined ponds as proposed for the other sites. The floating facility would consist of net pens anchored just outside the small backwater at the west side of the project site. Each of these concepts is discussed in more detail in the following narrative. Site plans showing each concept are provided in Figures 3-5. Detail drawings of the proposed concrete raceways and asphalt ponds are found in the Summary Report.

### A. Land Based Facility

This concept would have eight - 10 by 100 by 3.5 foot deep concrete raceways, four - 40 by 80 by 4 foot deep asphalt ponds or eighteen - 8 by 80 by 2.5 foot deep vinyl raceways. The station manager's office/residence, the fish food freezer/preparation building, a fish ladder for returning adults and security fencing are also part of this land based concept.

Water supply for the raceways or ponds would come from a combination of river and ground water or river and wasteway water. Ground or wasteway water (whichever is chosen) would be for imprinting. In addition to cheaper pumping costs, river water is used to lower the mix temperature and improve quality.

The selection between wasteway and well water is not entirely an engineering decision. There appears to be an adequate volume of wasteway water available by gravity flow, but its quality does not meet the minimum standards. As discussed later, several parameters are exceeded, but similar quality water is currently being successfully used at the WDF Ringold Facility. Ground water very 1 i kely would have better quality, but there is an additional expense for well construction and pumping. Construction cost estimates for each alternative are provided in Table 1.

The U.S. Department of the Interior, Geological Survey maintained a gaging station on the wasteway from February 21, 1986 to April 23, 1987. Flow records are found in Appendix B. For May, 1986, the mean, maximum and minimum flows were 8.35, 11, and 4.9 cfs, respectively. Because the wasteway water is warm with inferior quality, a maximum flow of only 2 cfs is planned for use at the facility. The remaining 13 cfs needed would be pumped from the river. A pipeline intake on the wasteway would consist of a small dam and impoundment 4 to 6 feet deep. A IO-inch pipe would penetrate the dam, and water would enter after first flowing through fine screens.

One to two cfs of ground water would probably be available from a 200 foot deep well (refer to the June 4, 1987 Report of Ground Water Resource Evaluation, Walla Walla and White Bluffs Acclimation Facilities, Walla Walla and Franklin Counties, Washington by GeoEngineers, Inc. in Appendix C). The well would be located close to the site and water pumped by an approximately 65 horsepower motor through a 10 inch pipeline. This water source has not been included in the cost estimate totals since the wasteway water is a much cheaper imprinting supply.

The river water pump station would be a pile supported structure built a short way into the river near the boat launch ramp. It would require approximately 85 horsepower to pump 14 cfs. However, the design recommendation is for three pumps, each with a 35-horsepower motor capable of pumping 6 cfs. A conceptual design drawing is shown on Figure 14 in the Summary Report. The delivery pipeline would be 24 inches diameter and roughly 1,650 feet long. The raceways and ponds are not located closer to the pump station because that would make the fish ladder much more expensive to construct. In the position shown, the vertical distance between the raceway/ponds and the drain channel is less, and the additional pipe cost is offset by savings in fish ladder construction.

B. <u>Floating Facility</u>

This concept calls for six net pen cages, each 12 meters by 12 meters by 5 meters deep (40 by 40 by 16 feet). The pens would be anchored outside the east backwater and the support facilities would be located on the shore nearby. This net pen location is out of the main Columbia River flow, but there are eddy currents present to deliver oxygen and remove wastes. Irrigation runoff water flowing through the backwater would provide a unique water source for imprinting the fish to this site.

If the zero day acclimation period fish were released directly into the river and the remaining three - 7,500.pound lots of fish were placed in the six pens, the resulting density would be 0.17 pounds per cubic foot (pcf). The maximum net pen density at the end of 21 days for the fourth lot of fish would be 0.31 pcf. This could be lowered by moving fish to empty pens after the second and third lots of fish are released.

Support facilities on shore would include the office/residence and fish food freezer/preparation building. These would be in a fenced enclosure on the low bluff overlooking the pens. Fry would be loaded into the pens by tank truck from this location using 200 feet or so of hose. Fish food would be loaded into a vehicle and moved to the boat launch ramp. There, it would be put into a boat and taken to the pens. A dock would be built next to the ramp to facilitate this operation.

An adult holding and spawning concept that goes with floating net pen rearing is shown conceptually in Figure 5. It consists of a single asphalt-lined pond and fish ladder. Water supply would be gravity flow from the wasteway channel. Returning adult salmon would be diverted up the fish ladder by setting picket fences over the main wasteway stream.

This is not an ideal concept for adult capture, holding and spawning because the water temperature may be too high. The wasteway temperature is high to begin with (although measurements in October and November are not available) and a shallow holding area will make it worse. Columbia River water that mixes in will lower the temperature, but to what degree is unknown.

## C. Electrical Power and Telephone

Because the White Bluffs site is so remote, it will cost over $140,000 to bring in electrical power. Instead of making such a large expenditure for only one month of operation each year, diesel power generation is recommended. For the land based concept, where continued pump operation is extremely critical, a primary and a standby generator is proposed. Each one would be large enough to run the pumps, food freezer, and miscellaneous loads. There would be automatic switch gear and starters so that in case of failure, the standby unit would take over. Power requirements for the floating concept are not as critical and, therefore, only a smaller single generator is proposed.

Each generator would be totally self contained in a moveable enclosure and be truck transportable. At the start of rearing it would be brought on-site and connected to buried wiring. At the end of rearing the generators could be moved elsewhere for other uses.

Telephone communications are also prohibitively expensive at White Bluffs. Instead of making the required $29,300 expenditure for telephone line extensions, radios are recommended. The system included in the cost summary is a Mororol a Trunked mobile radio. It would use nearby repeaters to access conventional telephone lines.

## V WATER QUALITY AND TEMPERATURES

On May 19, 1987, water samples were collected from the river just east of the east backwater and from the irrigation wasteway. These were taken to AM Test, Inc. in Redmond, Washington for analysis. Results are provided in Appendix E.

The river water sample had concentrations of ammonia and zinc in excess of the maximum desired level listed in the U.S. Fish & Wildlife proposal to Bonneville Power Administration. Also, pH was slightly above the desired range. The wasteway water sample showed chloride, ammonia, total dissolved solids and zinc above the maximum concentrations. The wasteway pH was also high.

On May 19, 1987, two river water temperature measurements were taken. The temperature in the strong river current between the east and west backwaters was 54 degrees F. The river in a shallow area adjacent to the east backwater had a temperature of 55 degrees F. Also on May 19, the wasteway water temperature was measured at 68 degrees F. On June 22, 1987 the wasteway water temperature was 67 degrees F.

Two cfs of 68 degree F water mixed with 13 cfs of 54 degree F water produces 15 cfs at 56 degrees F.

# VI COST SUMMARY

At White Bluffs two alternative concepts consisting of a land based facility with either concrete or vinyl raceways or asphalt or membrane ponds and a floating facility are proposed. Construction cost summaries, exclusive of land acquisition or professional services fees, are shown in Table 1.

- TABLE 1 -

WHITE BLUFFS COST SUMMARY

| | Concrete Raceways | Asphalt Ponds | Membrane Ponds | Vinyl Raceways | Floating Net Pens |
|---|---|---|---|---|---|
| Site Work | $199,000 | $229,300 | $229,300 | $199,000 | $108,000 |
| Ponds, Raceways, or Net Pens | 247,000 | 93,200 | 79,700 | 205,700 | 110,000 |
| Extra for Adult Capture | - | 21,000 | 21,000 | - | |
| River Water Pump Station | 197,400 | 197,400 | 197,400 | 197,400 | |
| Ground Water Well* | (48,100) | (48,100) | (48,100) | (48,100) | |
| Office/Housing | 12,500 | 12,500 | 12,500 | 12,500 | 12,500 |
| Food Freezer/Prep. Bldg.** | 48,900 | 48,900 | 48,900 | 48,900 | 48,900 |
| Diesel Generators | 66,800 | 66,800 | 66,800 | 66,800 | 3,000 |
| Motor Starters, Switch Gear | 11,400 | 11,400 | 11,400 | 11,400 | |
| Radio Communications | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Electric Utility* | (141,000) | (141,000) | (141,000) | (141,000) | (141,000) |
| Telephone Utility* | (29,300) | (29,300) | (29,300) | (29,300) | (29,300) |
| Subtotal | 785,000 | 682,500 | 669,000 | 743,700 | 284,400 |
| 15% Contingency | 117,800 | 102,400 | 100,400 | 111,600 | 42,700 |
| Total | $902,800 | $784,900 | $769,400 | $855,300 | $327,100 |
| Monthly Pumping Cost | 5,800 | 5,800 | 5,800 | 5,800 | 400 |

* Shown for information only. Not included in totals.
** Portable Freezer Van Alternative Cost = $41,500.

## VII ADVANTAGES AND DISADVANTAGES

The White Bluffs site has the following advantages and disadvantages:

River water must be pumped.

Gravity flow irrigation runoff water is available.

River currents appear adequate for net pen rearing.

The site is very remote.

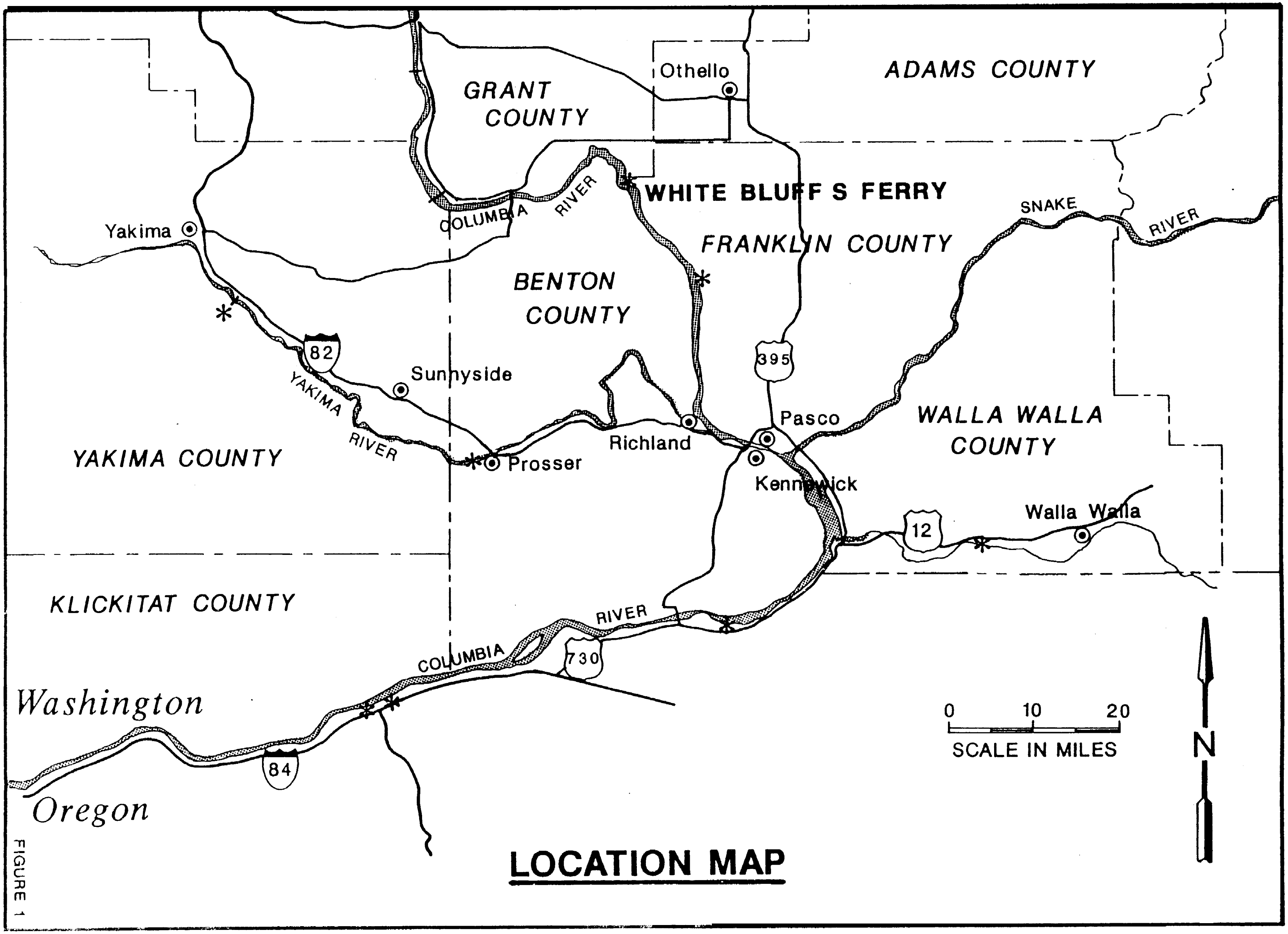
Costs for telephone and power services are quite high and therefore radios and on-site generation is recommended.

Security could be difficult when the facility is not staffed.

There are potential fish health problems.

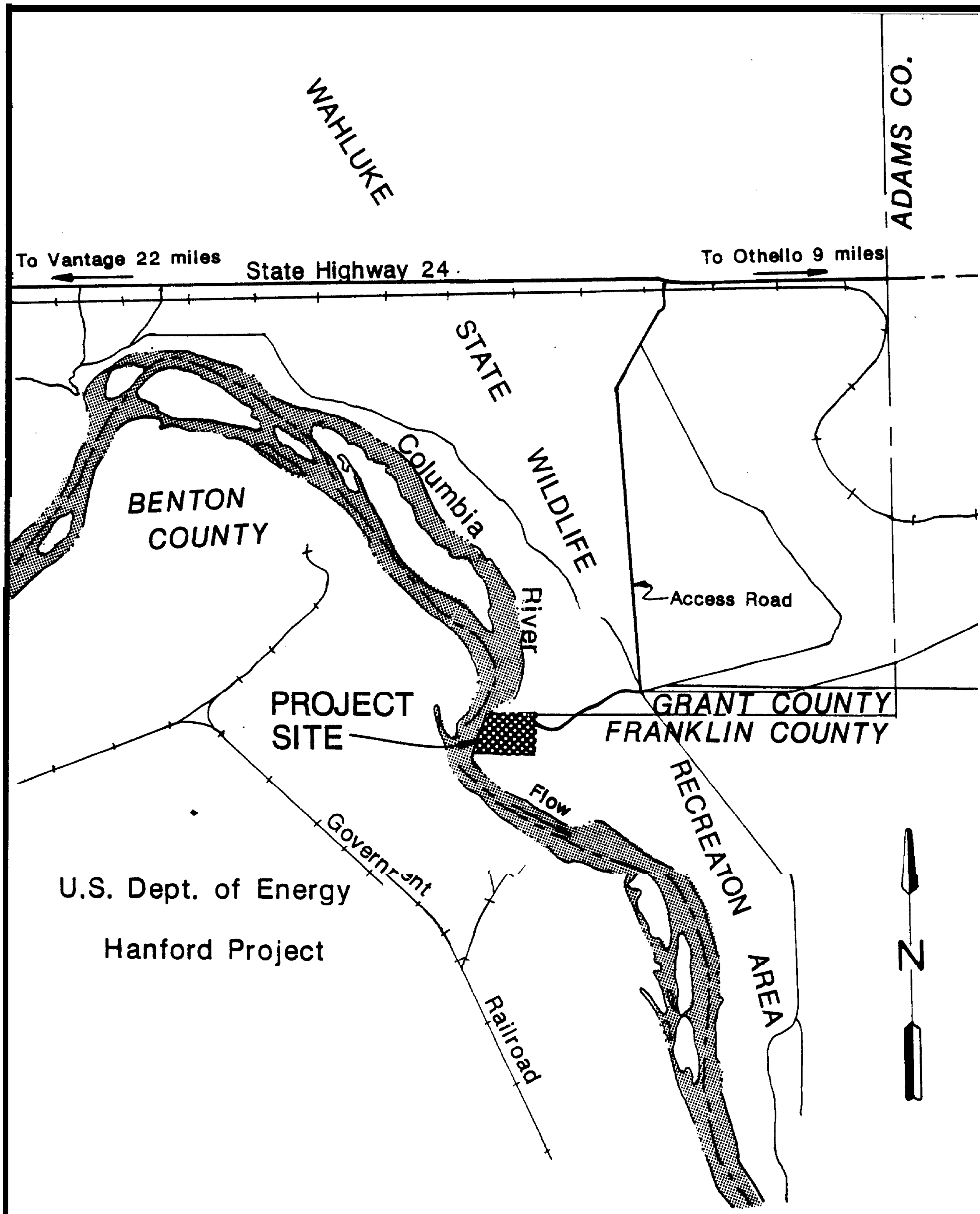
The irrigation water has excess concentrations of ammonia, chloride, zinc, and total dissolved solids. Also the pH is higher than desired.

River water has excess concentrations of ammonia and zinc and a slightly elevated pH.




LOCATION MAP

FIGURE 1

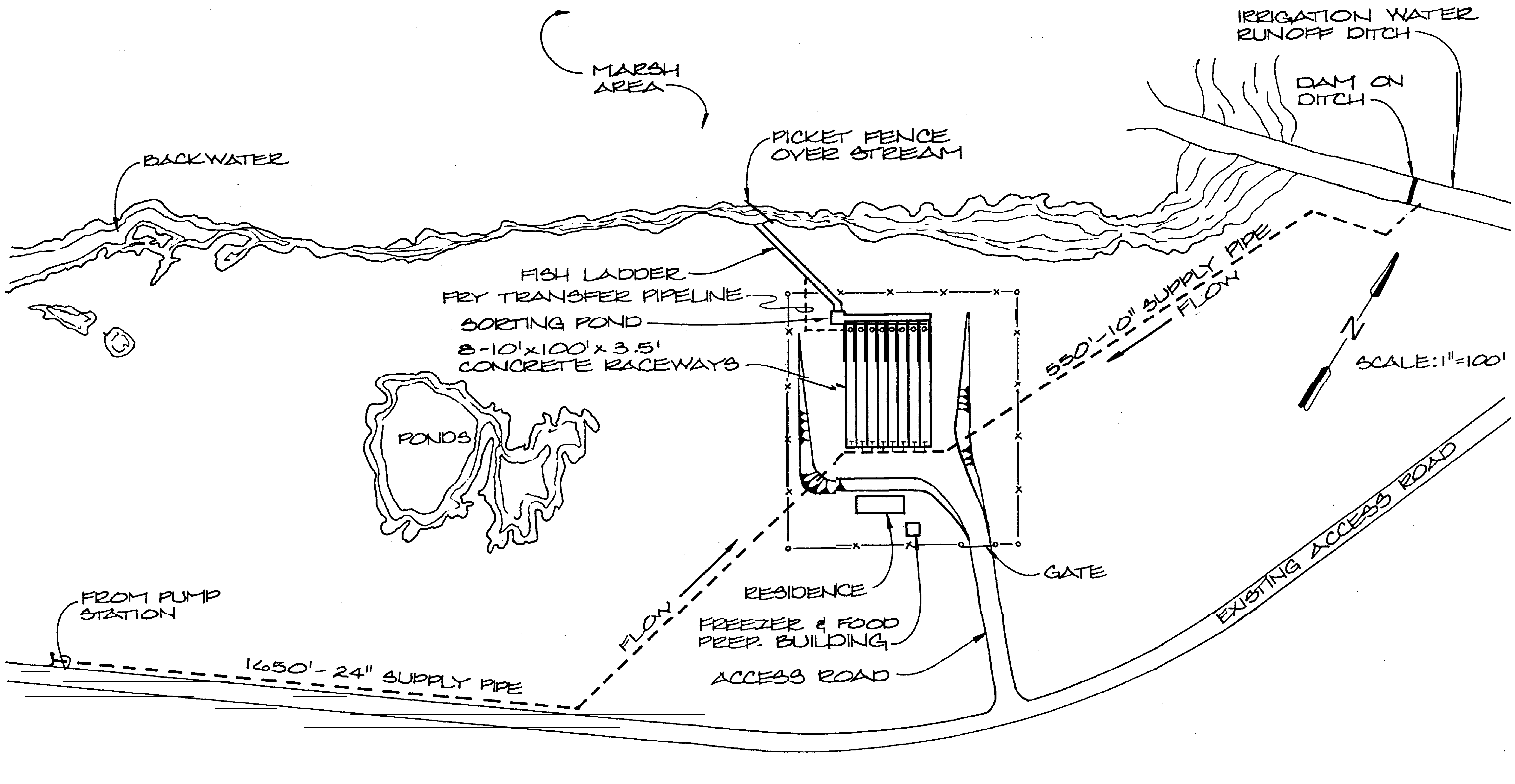



## VICINITY MAP

## WHITE BLUFFS FERRY

SCALE: 1"=2000'

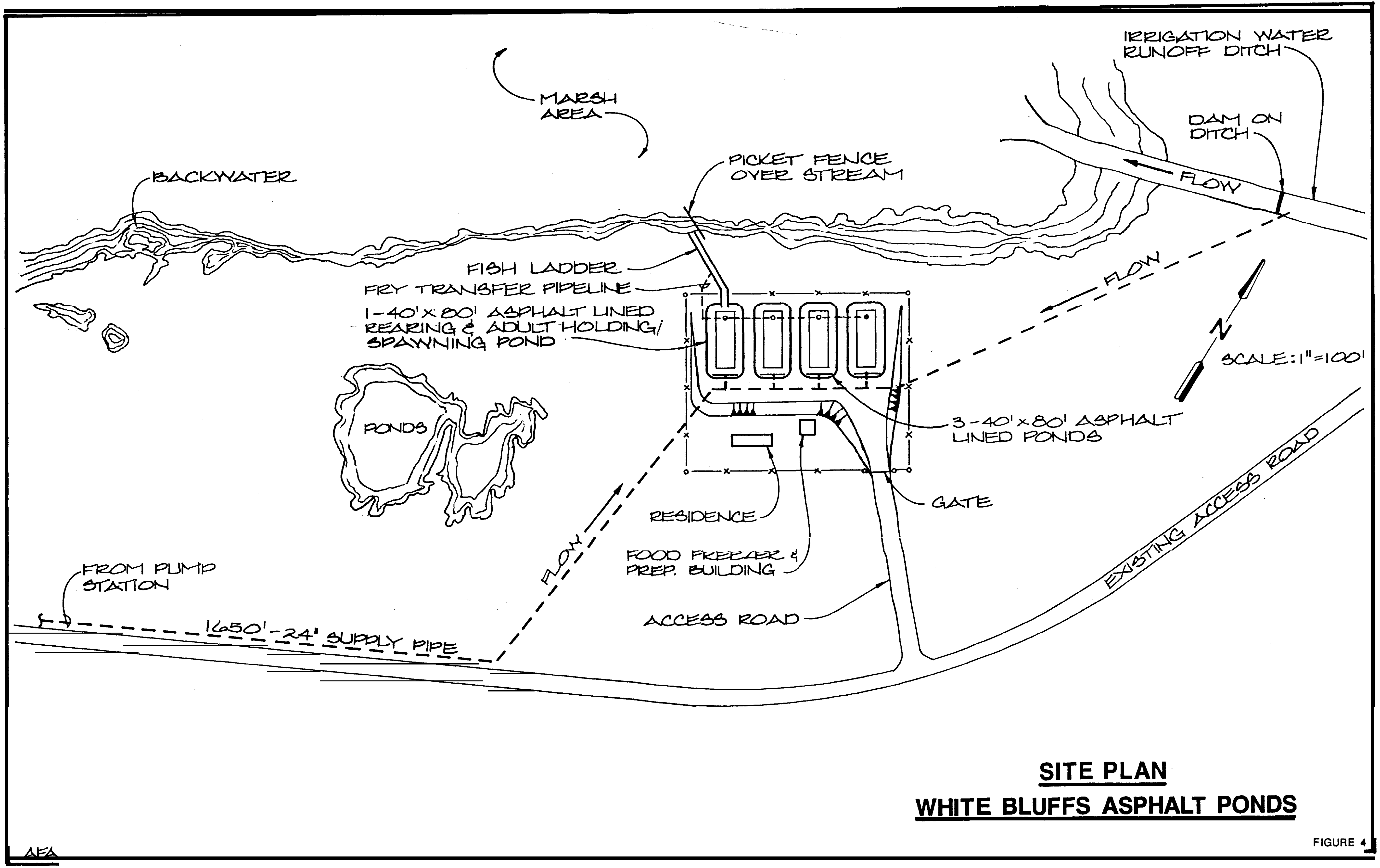
FIGURE 2




**SITE PLAN**

**WHITE BLUFFS CONCRETE RACEWAYS**

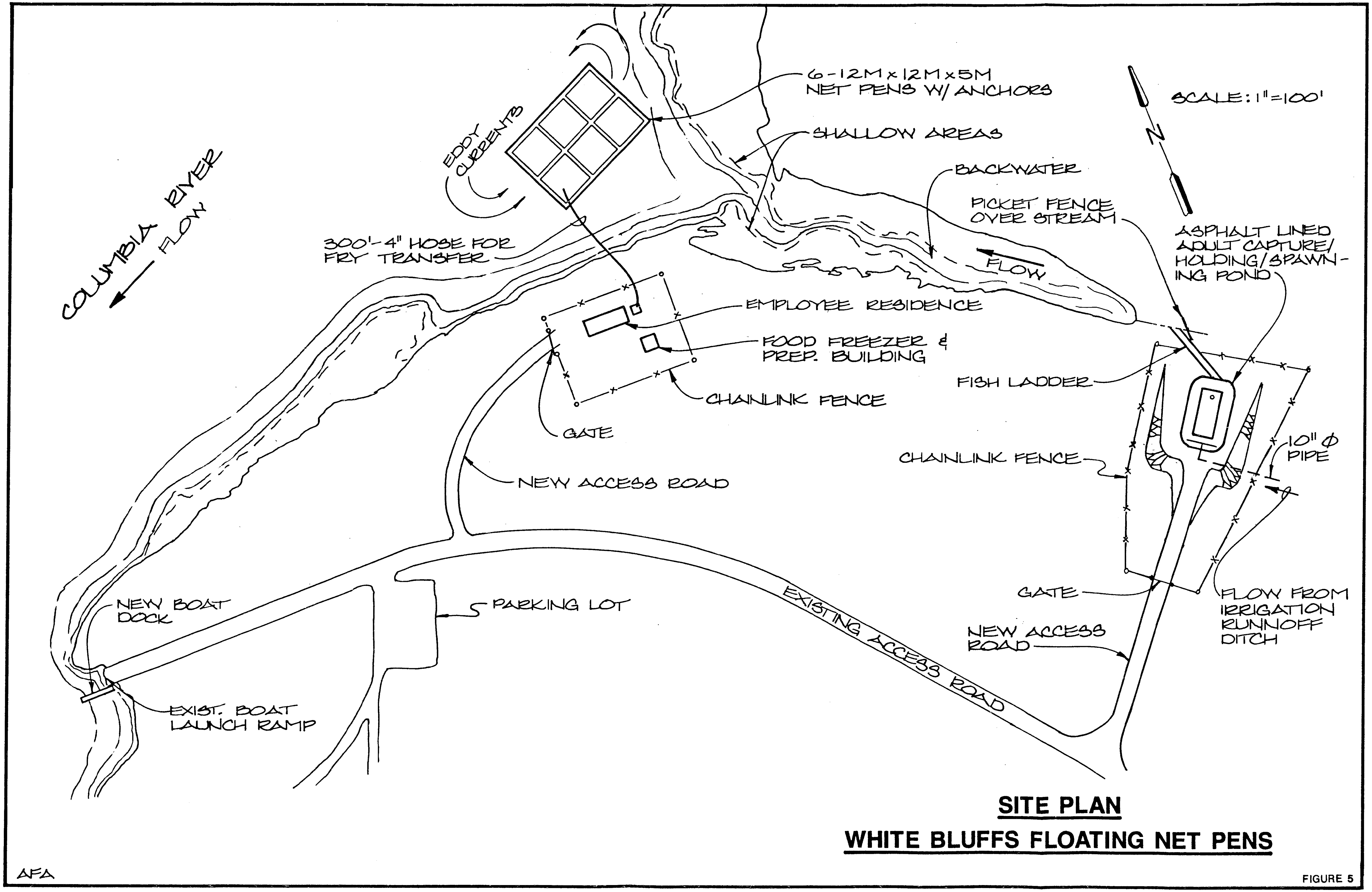
FIGURE 3




## SITE PLAN

## WHITE BLUFFS ASPHALT PONDS

FIGURE 4




**SITE PLAN**

**WHITE BLUFFS FLOATING NET PENS**

FIGURE 5

# APPENDIX A

## CORRESPONDENCE

Sverdrup

Sverdrup Corporation
1200-112th Avenue N.E., Suite C-143
P.O. Box 369
Bellevue, Washington 98009

206/454-9562

December 11, 1986

Grant County
Public Utility District No. '2
30 "C" Street S.W.
P.O. Box 878
Ephrata, Washington 98823

Attention: Mr. Jim Knight
Distribution Engineering Supervisor

Gentlemen:

Subject: John Day Acclimation Pond Study
White Bluffs Ferry Site
Electrical Power Service

Sverdrup Corporation is under contract to the U.S. Fish and Wildlife Service to prepare feasibility studies for salmon acclimation facilities at sites along the Yakima and Columbia Rivers. One of the sites being studied is known as the White Bluffs Ferry Site and is located on the east bank of the Columbia River at River Mile 370. The location information is as follows and, in addition, a site location map is enclosed:

<u>WHITE BLUFFS FERRY SITE</u>
To 14N. R. '27E. Sections 28 and 29
Franklin County, Washington
USGS _ Hanford, Washington, 15 Minute Series

As part of our feasibility studies, we will be studying a pumped river water intake that will have an estimated electrical service demand of 50 to 100 kilowatts, all motors, depending on the extent of site development. The use period for the facility will be one to two months during the late spring and early summer of each year. We would like to obtain the following information to include in our feasibility studies:

1. The approximate cost of supplying 50 to 100 kilowatts to the White Bluffs Ferry Site.

2. The rate charge per kilowatt hour; and any demand, transmission, or other applicable charges.

Prior to writing this letter, we telephoned transmission and distribution representatives of Franklin County Public Utility District and Grant County Public Utility District No. 2. The Franklin County representative stated that they did not have distribution facilities anywhere close to the site and suggested we contact Grant County Public

Utility district. The Grant County representative stated that by agreement with Frank County Public Utility District, they could supply power to a customer in Franklin County.

If you have any questions, please contact us.

Very truly yours,

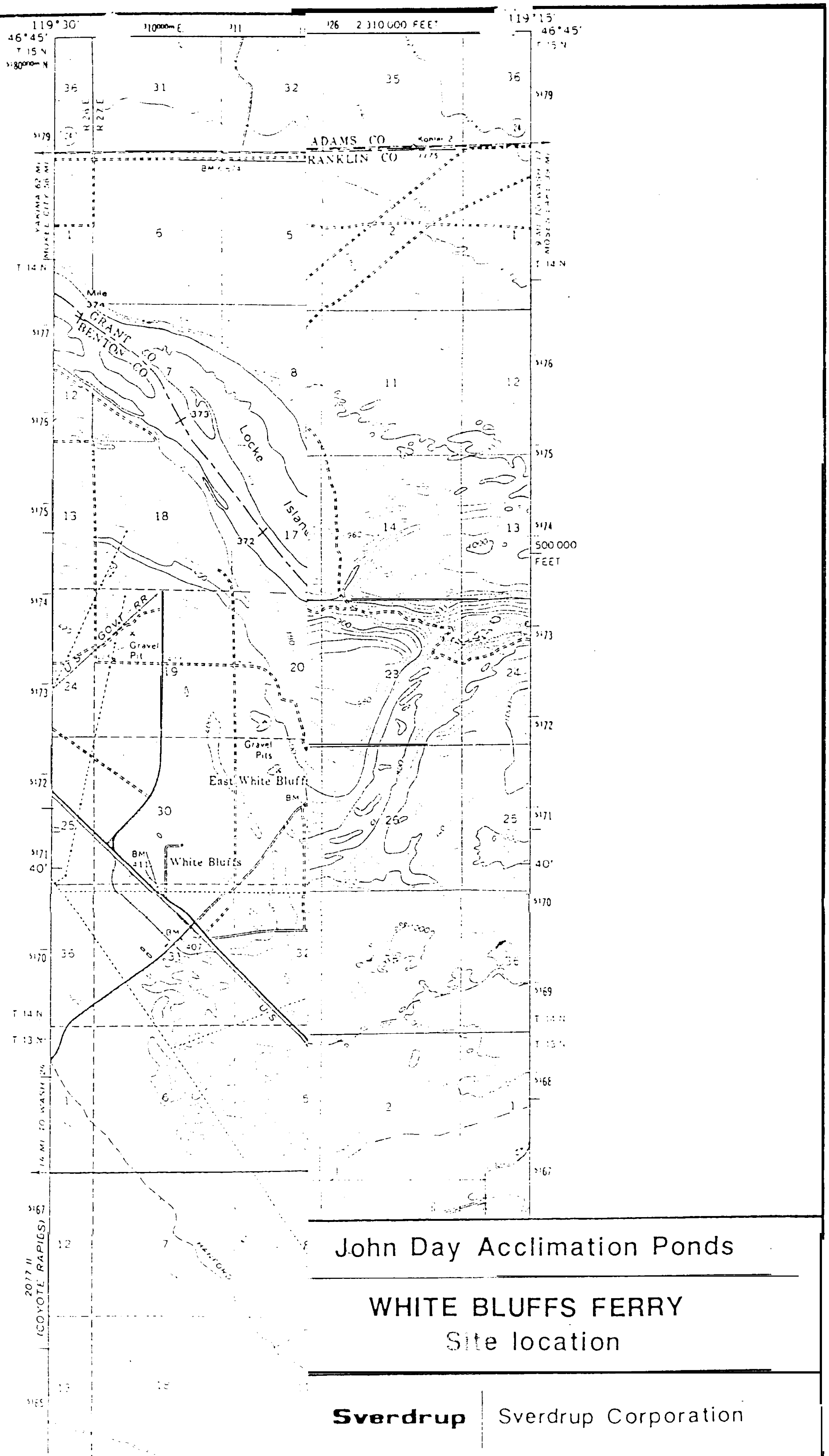
SVERDRUP CORPORATION

Glen M. Aurdahl

Glen M. Aurdahl, P.E.
Project Manager

Enclosure

cc: Mr. Bill Striplin




John Day Acclimation Ponds

WHITE BLUFFS FERRY

Site location

**Sverdrup** | Sverdrup Corporation

**PUBLIC UTILITY DISTRICT OF GRANT COUNTY**

P.O. BOX 878 • EPHRATA, WASHINGTON 98823 • 509/754-3541

December 16, 1986

Sverduup Corporation
1200-112th Ave. NE, Suite C-143
P.O. Box 369
Bellevue, WA 98009

Re: White Bluffs Ferry Site
T14, R27, S28 - 29

Gentlemen:

It appears the closest Grant County PUD power to this site is approximately 13 miles away on Road 24 SW and F.5 SW,

A first look indicates construction costs on a project of this type could run $35,000 per mile. Please keep in mind this is only a ball-park cost. Enclosed is a copy of the area and location of our facilities.

This service would probably fall into the General Service Rate Class No. 2 which presently is at 1.6 cents for the first 8200 KWHs, 1.3 cents for the next 3800 KWHs, then 1.275 cents for all KWHs over 12,000. This rate also has a basic monthly charge of $9.00.

I telephoned Big Bend Electric Cooperative and they told me that they had an existing powerline in T14, R28, S5 which would be much closer than ours. The telephone number for Big Bend Electric Cooperative in Mesa is 265-4221.

If you have any questions, olease contact me at (509) 754-3541, Ext. 2296.

Sincerely,

Jim Knight

Jim Knight, P.E.
Distribution Engineering Supervisor

JJK:JK:dl
Enclosures
G. Nieborsky

35,000) = 455,000

**Sverdrup**

Sverdrup Corporation
1200-112th Avenue N.E., Suite C-143
P.O. Box 369
Bellevue, Washington 98009

206/454-9562

December 19, 1986

Big Bend Electrical Cooperative
P.O. Box 27
Mesa, Washington 99343

Attention: Mr. Donn Bigelow

Gentlemen:

Subject: John Day Acclimation Pond Study
White Bluffs Ferry Site
Electrical Power Service

Sverdrup Corporation is under contract to the U.S. Fish and Wildlife Service to prepare feasibility studies for salmon acclimation facilities at sites along the Yakima and Columbia Rivers. One of the sites being studied is known as the White Bluffs Ferry Site and is located on the east bank of the Columbia River at River Mile 370. The location information is as follows and, in addition, a site location map is enclosed:

<u>WHITE BLUFFS FERRY SITE</u>
To 14N. R. 27E. Sections 28 and 29
Franklin County, Washington
USGS - Hanford, Washington, 15 Minute Series

As part of our feasibility studies, we will be studying a pumped river water intake that will have an estimated electrical service demand of 50 to 100 kilowatts, all motors, depending on the extent of site development. The use period for the facility will be one to two months during the late spring and early summer of each year. We would like to obtain the following information to include in our feasibility studies:

1. The approximate cost of supplying 50 to 100 kilowatts to the White Bluffs Ferry Site.

2. The rate charge per kilowatt hour; and any demand, transmission, or other applicable charges.

If you have any questions, please contact us.

Very truly yours,

SVERDRUP CORPORATION

Glen M. Aurdahl

Glen M. Aurdahl, P.E.
Project Manager

Enclosure

cc: Mr. Bill Striplin

PUD
FRANKLIN COUNTY
Public Power

PUBLIC UTILITY DISTRICT NO. 1
OF FRANKLIN COUNTY

P.O. BOX 2407 PASCO, WASHINGTON 99302 (509) 547-5591

January 16, 1987

RECEIVED
JAN 20 1987
SVERDRUP & PARCEL
& ASSOCIATES INC.

Glen Aurdahl
Sverdrup Corporation
P. O. Box 369
Bellevue, Washington 98009

Re: Electrical Service to White Bluff's Ferry Acclimation Pond

Dear Mr. Aurdahl: Ltr. 87-30

Your December 19, 1986 letter to Big Bend Electric Cooperative has been forwarded to me for response, since the site is in the District's service area.

The District's nearest distribution line is shown in red on the site location map you provided. Extension of service to the proposed 50 to 100 H.P. pump installation would require construction of approximately six miles of three phase overhead distribution line.

The estimated charges to extend the District's facilities to the site would be approximately $141,000.00. This estimate is based upon the following assumptions: (1) line routing as shown in green on the site location map, and (2) the site will be in operation a minimum of 6 years.

This is a very rough ballpark estimate of the cost to supply the site with three phase power. The District has not made a field review of the site or assumed line route; actual costs could vary greatly from the estimate. If necessary, we will be happy to prepare a more accurate estimate prior to your final site selection.

The customer is responsible for obtaining all permits or easements necessary to allow the District to construct, operate and maintain facilities located on the Hanford Reservation. In addition, a special line extension contract with the District may be required.

Mr. Glen Aurdahl
Ltr. W-30, pg. 2
January 16, 1987

A copy of the District's current General Service Rate Schedule is enclosed for your information.

If I can assist with questions or provide further information, please contact me at (509) 547-0556.

Sincerely,

FRANKLIN COUNTY P.U.D.

Bonnie Hickman

Bonnie Hickman
Lead Engineer

BH/sh

Enclosure

# PUBLIC UTILITY DISTRICT NO. 1 OF FRANKLIN COUNTY

## RATE SCHEDULE NO. 2
## GENERAL SERVICE RATE

AVAILABILITY: Service under this sechedle shall be available throughout the service area of the District for lighting and power to al? customers not covered under the other schedules.

TYPE of SERVICE: Sixty-cycle, alternating current at such phase and voltage as the District may have avaiiable.

MONTHLY CHARGES:

BASIC CHARGE:

Metered Service - s12.00
Unmetered Service - $10.CO

Energy Charge:

first 20,000 kWh @ 2.88¢/kWh
All over 20,000 kWh @ 1.51¢/kWh

Demand Charge: $0.43/kW of billing demand in excess of 50 kW, plus

For the billing months December through May, for demand created Monday through Saturday, 7 a.m. through 10 p.m.: $5.12/kW of billing demand in excess of 50 kW/month.

For the billing months June through November, for demand created Monday through Saturday, 7 a.m. through 10 p.m.: $2,87/kW of billing demand in excess of 50 kW/month.

MINIMUM CHARGE: Basic charge, but not less than $0.25 per month per kVA of transformer capacity required to serve the load unless otherwise provided by contract.

POWER FACTOR ADJUSTMENT: The measured demand for billing purposes will be increased 1% for each 1%, or fraction thereof, by which the average power factor is less than .95 lagging.

PRIMARY SERVICE DISCOUNT: A primary service discount of 25¢ per kilowatt on the demand charge may be allowed if the customer accepts service at primary voltage at a single delivery and metering point. The customer shall own and maintain all equipment on the load side of the system connection.

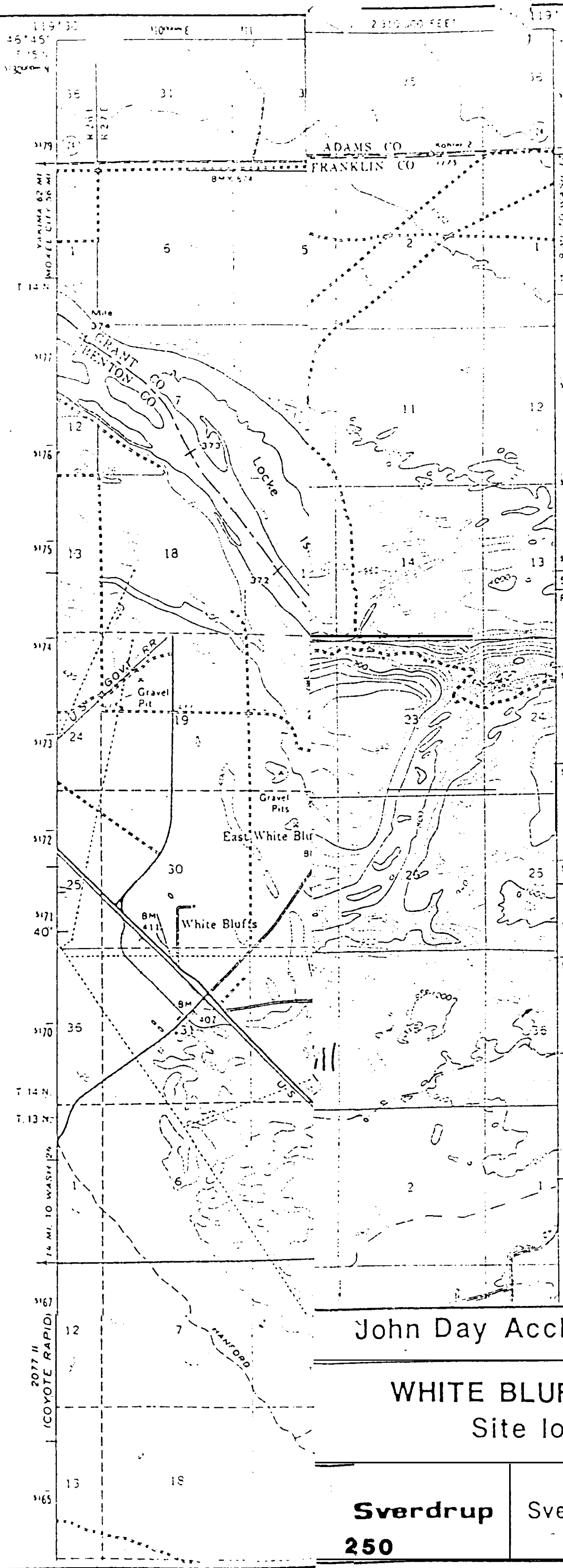
UNMETERED SERVICE: Unmetered service may be provided where, in the opinion of the District, the usage can be computed without the use of a meter.

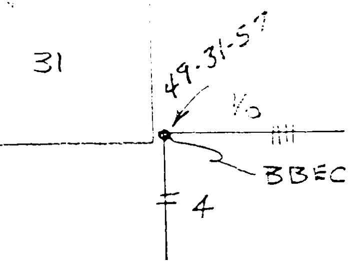
BILLINGS AND TERMS OF PAYMENT: Bills will be computed at monthly intervals. Bills are due and payable when issued, Failure to receive a bill shall not release the purchaser from liability for payment. Bills not paid in full on or before the fifteenth day after the date of the bill are subject to an additional charge. This charge shall be one percent (1%) of unpaid amounts on monthly bills and shall be applied at subsequent billings.

RATE SCHEDULE NO. 2 (( . tinued)

GENERAL TERMS AND CONDITIONS: Service under this classification is subject to the General Rules and Regulations of the District.

EFFECTIVE 2/14/84




GRANT CO. P.U.D.
SERVICE 13 MILES
AWAY
COST $455,000
$35,000/MILE

PUD NO. 1 OF FRANKLYN
COUNTY 6 MILES
AWAY
COST $141,000
$23,500/MILE

John Day Acclimation Ponds

WHITE BLUFFS FERRY
Site location

**Sverdrup** | Sverdrup Corporation

250

1200 112th Avenue NE
Suite C-143
P.O. Box 369
Bellevue Washington 98009
206 454-9562

June 10, 1987

Telephone Utilities of Washington
111 A Street
Cheney Washington 99004

Attention: Ann

Dear Ann:

Subject: Telephone Service to Ringold and White Bluffs

This is to inquire about the availability and cost for telephone service to two sites. This inquiry is being made for a feasibility study Sverdrup is doing for the U.S. Fish & Wildlife Service. We are evaluating ten sites at locations along the Columbia, Yakima and Walla Walla Rivers to determine their suitability for rearing chinook salmon fry. This work is funded by the Bonneville Power Administration and it is part of the John Day Dam salmon mitigation program. Projects actually constructed at one or more of these sites will be owned by Fish & Wildlife, and they will manage the facility or give it to the State of Washington to manage.

One location is at Ringold Springs on the Columbia River in Franklin County. The site is in the NW1/4 of Section 25, T12N, R28E. It is east of the Ringold Road/Old Ringold - Muir Road intersection. The enclosed Site Plan sketch and map should give you the exact location. We do not know where your telephone lines in this area are but they must be close. Both the Washington Departments of Game and Fisheries have fish facilities with employee housing and office space just north of our project. The Fisheries phone number is 269-4448.

The other location is at a spot on the Columbia River called White Bluffs, also in Franklin County. The site is in the NW1/4 of Section 28, T14N, R27E. It is at the old White Bluffs Ferry Crossing which is now part of the Wahluke State Wildlife Recreation Area. It is nine miles southwest of Othello on Washington State Highway 24, and on Highways 24 and 243 it is 22 miles southeast of Vantage. To reach the site from Vantage or Yakima, travel 9.3 miles east on Highway 24 from the Columbia River Vernita Bridge. Turn south onto the Wahluke Recreation Area and go 3.8 miles on an unpaved then paved road. Then turn east and go another 0.7 miles. The enclosed Site Plan sketch and map give the exact location. To my knowledge, there are no telephone lines anywhere near the White Bluffs site. If this is true and line extensions are prohibitively expensive, we will consider some sort of radio communications.

If standard telephone service is available at either site, all we need is a single line, rotary or touch tone. This phone would get infrequent use and we do not anticipate sending data or having automatic dialers in the event of emergencies.

Please review this request with your engineers and, at your earliest convenience, send me a letter that gives an approximate cost for providing this telephone service. I expect to be gone from the office for the next few weeks so if you have questions, please contact Glen Aurdahl at the phone number above.

Thank you very much for your assistance, and we look forward to hearing from you.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosures

RECEIVED
JUL 07 1987
SVERDRUP CORP.
SEATTLE OFFICE

PACIFIC TELECOM

Telephone Utilities
of Washington, Inc.
Eastern Washington Division
111 A Street
Cheney, Washington
99004

Telephone
509-235-5171

June 30, 1987

Sverdrup Corporation
1200 112th Avenue, N. E.
Suite C 143
PO Box 369
Bellevue, WA 98009

SUBJECT: Telephone Service to Ringold and White Bluffs

Dear Sirs:

Reference your request for availability of telephone service in the Ringold and White Bluffs area, the following information is submitted:

1. Ringold area:

   Telephone facilities would be available to this proposed site, with an estimated construction cost of $804.00, to construct approximately 1,600' of buried facilities.

2. White Bluffs area:

   This proposed site is approximately 7% miles from our nearest facilities and would require an estimated $29,304.00 in construction charges to provide physical plant approximately 39,600' in length.

Construction charges are quoted as stated by our tariff which is on file with the Washington State Utilities and Transportation Commission. This tariff provides for 528' of free construction, with the remaining portion charged at the rate of 75$ per foot.

If I can be of further assistance feel free to contact me at 509-299-3107 in Medical Lake, Washington.

Sincerely,

Dale C. Rogers,
Field Engineer

:st

**Department of Energy**
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

JUN 24 1985

Mr. Curtis Burley
U.S. Department of the Interior
Fish and Wildlife Service
Fisheries Assistance Office
9317 Highway 99, Suite I
Vancouver, WA 98665

Dear Mr. Burley:

In your letter dated April 30, 1985, you asked that we review your selections for permanent acclimation release sites for upriver bright fall chinook within Hanford. You may recommend the area on the east bank of the Columbia River at the White Bluffs ferry landing.

The west side of the Columbia River is within the secured boundaries of Hanford and contributes to the logistics of many DDE projects either in progress or in planning. Security within this area is also closely monitored. As future planned projects develop, safeguard and security concerns will be intensified. Access to controlled areas (west side of Columbia River) by non-DOE personnel and equipment on a permanent basis is not in DOE's best interests. We, therefore, cannot approve this option.

Your project has potential for benefiting the entire area. If we can be of further assistance in your selection, please call. Should the White Bluffs site on the east side of the river be selected, we would need to review and approve site construction plans.

Very truly yours,

Kenneth W. Bracken, Director
Facilities and Site Services Division

FSS:ELM

# APPENDIX B

## FLOW RECORDS, FLOOD PREDICTIONS

KCCV
6/1 AtA
WHITE BLUFFS

# UNITED STATES
# DEPARTMENT OF THE INTERIOR

**GEOLOGICAL SURVEY**
Water Resources Division

May 28, 1987

Sveredrup Engineers
P. 0. Box 369
Bellevue, WA 98009

Attention: Harold Anderson

Enclosed, as requested by phone on May 22, are tables of mean daily discharge for Feb. 21, 1986, through Apr. 23, 1987, for station 12473200 South Columbia Basin Irrigation District WI310 Wasteway near Whitebluffs, WA. These discharges are provisional. Days flagged with an "a" are estimated. Maximum instantaneous discharge was 15 cfs.

Although the gage structure is still in place, we are no longer collecting record. The gage structure will probably be removed this fall.

Sincerely yours:'

Phillip R. Boucher,
Field Office Chief

CC: Brian Drost
Greg Ruppert
PRB/jo

1 1987 WY UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

12473200 S.C.B.I.D. WB10 WASTEWAY NR MOUTH NR WHITEBLUFFS, PROCESS DATE: 26-MAY-87 08:08 GPR
LAT 000000 LONG 0000000 STATE 53 COUNTY 021 DATUM OF GAGE: DRAINAGE AREA:

PROVISIONAL DATA DISCHARGE (CUBIC FEET/SECOND) WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.1 | 7.7 | 5.1 | 5.8 | 8.3 | 3.5 | 1.2 | | | | | |
| 2 | 5.2 | 7.1 | 4.9 | 6.1 | 8.6 | 3.4 | 1.2 | | | | | |
| 3 | 4.6 | 6.5 | 4.8 | 6.6 | 8.5 | 3.4 | 1.5 | | | | | |
| 4 | 7.1 | 6.2 | 4.5 | 6.8 | 7.9 | 3.5 | 4.6 | | | | | |
| 5 | 9.2 | 6.2 | 4.9 | 6.6 | 6.9 | 3.6 | 3.2 | | | | | |
| 6 | 8.6 | 6.0 | 5.6 | 6.3 | 6.3 | 3.7 | 2.8 | | | | | |
| 7 | 7.6 | 6.7 | 5.7 | 6.0 | 6.0 | 4.0 | 3.1 | | | | | |
| 8 | [illegible] | 6.2 | 5.5 | 5.6 | 6.0 | 4.8 | 3.6 | | | | | |
| 9 | [illegible] | 5.9 | 4.9 | 5.1 | 5.8 | 4.4 | 3.9 | | | | | |
| 10 | 7.7 | 5.2 | 4.8 | 4.6 | 5.7 | 3.7 | 4.1 | | | | | |
| 11 | 7.1 | 5.1 | 4.5 | 3.9 | 5.7 | 3.6 | 4.8 | | | | | |
| 12 | 5.9 | 4.9 | 4.6 | 4.0 | 5.6 | 4.5 | 7.0 | | | | | |
| 13 | 5.6 | 5.1 | 4.9 | 4.5 | 5.9 | 5.4 | 10 | | | | | |
| 14 | 5.3 | 5.2 | 5.2 | 5.0 | 5.0 | 6.2 | 10 | | | | | |
| 15 | 5.3 | 5.3 | 5.1 | 4.3 | 5.9 | 6.3 | 10 | | | | | |
| 16 | 5.8 | 5.4 | 5.4 | 6.3 | 5.7 | 6.0 | 10 | | | | | |
| 17 | 6.6 | 5.5 | 5.4 | 6.3 | 5.5 | 5.4 | 10 | | | | | |
| 18 | 7.0 | 5.8 | 5.4 | 6.2 | 5.2 | 4.9 | 9.8 | | | | | |
| 19 | 6.7 | 5.6 | 5.7 | 6.1 | 4.8 | 4.9 | 9.1 | | | | | |
| 20 | 6.0 | 6.1 | 5.8 | 6.1 | 4.4 | 5.1 | 8.2 | | | | | |
| 21 | 5.9 | 6.2 | 5.7 | 6.1 | 4.2 | 5.0 | 7.7 | | | | | |
| 22 | 8.6 | 5.3 | 5.9 | 5.1 | 4.3 | 4.6 | 7.6 | | | | | |
| 23 | 9.9 | a5.3 | 6.1 | 6.1 | 7.1 | 4.2 | 7.7 | | | | | |
| 24 | 9.5 | a5.2 | 6.4 | 6.0 | 8.2 | 3.8 | --- | | | | | |
| 25 | 8.5 | 5.2 | 6.2 | 6.0 | 4.6 | 3.3 | --- | | | | | |
| 26 | 7.5 | 4.4 | 6.5 | 4.0 | 4.1 | 2.9 | --- | | | | | |
| 27 | 7.4 | 4.5 | 6.4 | 4.0 | 3.9 | 2.5 | --- | | | | | |
| 28 | 0.3 | 4.9 | 6.2 | 5.8 | 3.6 | 1.9 | --- | | | | | |
| 29 | 8.6 | 5.3 | 6.1 | 6.4 | --- | 1.6 | --- | | | | | |
| 30 | 8.6 | 5.2 | 6.0 | 7.0 | --- | 1.4 | --- | | | | | |
| 31 | 8.5 | --- | 5.6 | 7.1 | --- | 1.3 | --- | | | | | |
| TOTAL | 223.3 | 169.2 | 169.8 | 177.6 | 164.7 | 122.8 | --- | | | | | |
| MEAN | 7.20 | 5.64 | 5.48 | 5.73 | 5.88 | 3.96 | --- | | | | | |
| MAX | 9.9 | 7.7 | 6.5 | 7.1 | 8.6 | 6.3 | | | | | | |
| MIN | 4.6 | 4.4 | 4.5 | 3.9 | 3.6 | 1.3 | | | | | | |
| AC-FT | 443 | 336 | 337 | 352 | 327 | 244 | --- | | | | | |

1 1986 WY UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY - WATER RESOURCES DIVISION

12473200 S.C.B.I.D. WB10 WASTEWAY NR MOUTH NR WHITEBLUFFS, PROCESS DATE: 27-FEB-87 16:31 GPR
LAT 000000 LONG 0000000 STATE 53 COUNTY 021 DATUM OF GAGE: DRAINAGE AREA:

PROVISIONAL DATA DISCHARGE (CUBIC FEET/SECOND) WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986
MEAN VALUES

| DAY | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | --- | 9.2 | 3.2 | 8.3 | 4.0 | 4.6 | 1.3 | 6.5 |
| 2 | | | | | --- | 8.6 | 3.0 | 9.1 | 3.2 | 4.8 | 2.6 | 7.1 |
| 3 | | | | | --- | 8.3 | 2.8 | 9.8 | 2.4 | 5.6 | 4.1 | 8.0 |
| 4 | | | | | --- | 9.2 | 2.3 | 9.4 | 1.7 | 5.8 | 4.3 | 8.2 |
| 5 | | | | | --- | 10 | 1.9 | 9.0 | 1.4 | 5.7 | 4.4 | 7.5 |
| 6 | | | | | --- | 10 | 1.9 | 9.3 | 1.2 | 5.2 | 5.3 | 6.5 |
| 7 | | | | | --- | 10 | 2.4 | 10 | 1.0 | 5.1 | 7.1 | 5.6 |
| 8 | | | | | --- | 11 | 5.2 | 11 | a .90 | 5.8 | 7.7 | 6.2 |
| 9 | | | | | --- | 11 | 3.7 | 9.9 | .80 | 5.9 | 7.7 | 8.4 |
| 10 | | | | | --- | 10 | 3.7 | 8.8 | .70 | 6.0 | 7.7 | 9.4 |
| 11 | | | | | --- | 9.9 | 4.2 | 7.8 | .60 | 6.1 | 7.1 | 9.8 |
| 12 | | | | | --- | 9.6 | 4.4 | 7.7 | .40 | 5.5 | 6.7 | 9.9 |
| 13 | | | | | --- | 9.1 | 5.0 | 7.9 | .30 | 5.0 | 6.8 | 9.7 |
| 14 | | | | | --- | 8.7 | 7.9 | 7.7 | .20 | 4.5 | 7.8 | 9.7 |
| 15 | | | | | --- | 8.2 | 7.7 | 7.5 | .10 | 3.7 | 8.0 | 12 |
| 16 | | | | | --- | 7.7 | 8.0 | 7.5 | .10 | 3.1 | 7.6 | 14 |
| 17 | | | | | --- | 7.1 | 8.4 | 8.2 | .10 | 3.0 | 6.8 | 15 |
| 18 | | | | | --- | 6.6 | 8.5 | 8.2 | .10 | 3.0 | 6.3 | 14 |
| 19 | | | | | --- | 6.1 | 8.4 | 8.8 | .10 | 2.9 | 6.9 | 13 |
| 20 | | | | | --- | 5.7 | 8.1 | 9.0 | .10 | 2.8 | 7.1 | 12 |
| 21 | | | | | 9.0 | 5.4 | 7.2 | 8.7 | a 1.0 | 2.9 | 6.3 | 12 |
| 22 | | | | | 8.9 | 5.0 | 6.3 | 8.4 | 3.6 | 2.9 | 5.4 | 13 |
| 23 | | | | | 9.8 | 4.9 | 6.1 | 8.2 | 4.3 | 2.5 | 4.8 | 12 |
| 24 | | | | | 11 | 5.3 | 6.8 | 8.4 | 3.4 | 2.2 | 4.8 | 12 |
| 25 | | | | | 11 | 5.5 | 8.7 | 8.9 | 2.6 | 1.9 | 5.4 | 11 |
| 26 | | | | | 11 | 5.5 | 9.1 | 8.6 | 1.9 | 1.2 | 5.6 | 9.8 |
| 27 | | | | | 10 | 5.5 | 8.1 | 8.2 | 1.4 | 1.1 | 5.1 | 8.5 |
| 28 | | | | | 9.7 | 5.5 | 7.8 | 7.5 | 2.1 | 1.0 | 4.8 | 7.6 |
| 29 | | | | | --- | 5.1 | 7.8 | 6.6 | 3.3 | 1.0 | 5.1 | 6.8 |
| 30 | | | | | --- | 4.9 | 8.1 | 5.7 | 4.3 | 1.0 | 5.5 | 6.5 |
| 31 | | | | | --- | 4.3 | --- | 4.9 | --- | 1.1 | 5.8 | --- |
| TOTAL | | | | | | 232.9 | 176.7 | 259.0 | 47.30 | 112.9 | 181.9 | 291.7 |
| MEAN | | | | | | 7.51 | 5.69 | 8.35 | 1.58 | 3.64 | 5.87 | 9.72 |
| MAX | | | | | | 11 | 9.1 | 11 | 4.3 | 6.1 | 8.0 | 15 |
| MIN | | | | | | 4.3 | 1.9 | 4.9 | .10 | 1.0 | 1.3 | 5.6 |
| AC-FT | | | | | --- | 462 | 350 | 514 | 94 | 224 | 361 | 579 |

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 18. 1987

U.S. Army Corps of Engineers
Seattle District
P.O. Box C 3755
Seattle, WA 98124

Attention: Mr. Ken Pick
Flood Plain Management Service

Gentlemen:

Subject: Columbia River Flood Levels

Thank you for offering to provide us with Columbia River flood levels.

We are conducting a chinook salmon fry acclimation feasibility study for the U.S. Fish and Wildlife Service and we need water elevations for both 50 and 100 year recurrance interval floods. The two sites we are most interested in are White Bluffs at river mile 370 and Ringold Springs at river mile 355. Both are shown on the enclosed map.

From our phone converstation today I understand that you have predicted flood levels for river miles 388 and 351. I had hoped that your information would have been for locations closer to our sites. However, I realize we can't always have what we want.

At your convenience please send a letter that states what these elevations are. And, if you find there is additional data please send it also.

Again, thank you for your help.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX C-3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO
ATTENTION OF

MAY 28 1987

Hydrology and Hydraulics Branch

Mr. Harold T. Andersen
Sverdrup Corporation
1200 112th Avenue Northeast
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

Dear Mr. Andersen:

This is in response to our telephone conversation and your May 18, 1987 letter requesting Columbia River flood levels for river miles 355 and 370.

The following elevations are based upon the best available flood profile data for this reach of the Columbia River:

| River Mile | Flood Frequency | Approximate Flood Elevation (feet NGVD) |
|---|---|---|
| 344 | 100-year | 355 |
| 351 | 100-year | 363 |
| 388 | 100-year | 415 |
| 388 | 50-year | 414 |

If you have further questions, please call me at telephone (206) 764-3661.

Sincerely,

Kenneth H. Pick

Kenneth H. Pick, P. E.
Program Manager
Flood Plain Management Services

mile
351

# APPENDIX C

# GROUND WATER HYDROLOGY

REPORT OF GROUND WATER RESOURCE EVALUATION
WALLA WALLA AND WHITE BLUFFS ACCLIMATION FACILITIES
WALLA WALLA AND FRANKLIN COUNTIES, WASHINGTON
FOR THE
U.S. FISH AND WILDLIFE SERVICE



GeoEngineers
Incorporated

GeoEngineers Incorporated

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Consulting Geotechnical
Engineers and Geologists

June 4, 1987

Sverdrup Corporation
1200 - 112th Avenue Northeast
Bellevue, Washington 98009

Attention: Mr. Harold T. Andersen

Gentlemen:

We are submitting four copies of our report describing the results of our evaluation of the ground water resources at the proposed Walla Walla and White Bluffs acclimation facilities. The scope of our services is given in our technical services agreement with Sverdrup Corporation dated May 26, 1986.

We appreciate the opportunity to be of service and look forward to working with Sverdrup and the U.S. Fish and Wildlife Service in exploring and developing a ground water resource at the proposed acclimation facilities. Please call if you have any questions regarding our report.

Yours very truly,

GeoEngineers, Inc.

James A. Miller

James A. Miller
Principal

SEW:JAM:cs

File No. 0758-11-4

# TABLE OF CONTENTS



List of Figures

REPORT OF GROUND WATER RESOURCE EVALUATION
WALLA WALLA AND WHITE BLUFFS ACCLIMATION FACILITIES
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FOR THE
U.S. FISH AND WILDLIFE SERVICE

## INTRODUCTION

The results of the potential for developing ground water supplies at the proposed Walla Walla and White Bluffs acclimation facilities are presented in this report.

Our evaluation of the potential for development of ground water supplies at the proposed facilities is based on a review of available water well reports borehole geophysical logs and available publications.

## WALLA WALLA REGION

### GENERAL

The Walla Walla site is located on the Russel Bergevin Ranch in T7NR34E Sections 30 and 31. The location of the site is shown in Figure 1. The Walla Walla River transects the Bergevi Ranch. We understand that the proposed acclimation facility will take advantage of two surface water impoundments located near the river. One impoundment requires approximately 1 cfs (450 gpm) of ground water for development. The second impoundment will rely upon an existing drainage ditch as a water supply.

### REGIONAL HYDROGEOLOGY

The geology of the area is divided into three distinct hydrogeologic units--the upper sand and gravel, silt and clay known as Touchet Beds, and the Columbia River Basalt Group.

The upper sand and gravel unit is exposed along the banks of the Walla Walla River and extends to depths ranging from 80 to 115 feet. This aquifer heavily used in the Walla Walla region. The character of the aquifer Is highly variable near the Bergevin Ranch and well capacities range from 75 gpm/ft to less than 1 gpm/ft (see Table 1).

Fine-grained silt and clay deposits of the Touchet Beds define the base of the upper sand and gravel unit. The clay unit acts as an aquitard and does not yield appreciable quantities of ground water to wells. The clay unit is as much as 130 feet thick.

The lower hydrogeologic unit consists of igneous rock from the Columbia River Easalt Group (CRBG). Basaltic lava belonging to the Saddle Mountains subgroup are found at depth near the Bergevin Ranch (Figure 2). Several aquifers capable of producing large quantities of ground water are contained within the basalt flows; however, the Walla Walla region is known for warm ground water temperatures within the basalt aquifers.

We understand that ground water temperatures above 20 degrees Celsius are not suitable for the rearing of fish. Using available information, we have plotted local bottom-hole temperatures versus bottom-hole depths on Figure 3. Based on this plot, we estimate that the 20 degrees Celsius is otherm occurs approximately 500 feet below ground surface in the Bergevin Ranch area.

## RECOMMENDATIONS

Based on our review of available data, it IS our opinion the that Bergevin Ranch site shows a good potential for the development of a 1 cfs ground water supply. Well production and yields in this study area appear to be highly dependent upon the variability of the shallow aquifer and well construction techniques. We recommend the installation of a 10- to 12-inch-diameter test well to a maximum depth of 500 feet. In the event only small volumes of water are encountered in the upper sand and gravel unit, a field decision can be made to deepen the test well and explore the upper basalt flows. The aquifers encountered can be hydrologically and chemically tested during and after drilling. A pump test of the well will provide site-specific information necessary for design and construction of a well field.

# WHITE BLUFFS REGION

## GENERAL

The White Bluffs site is located in the northern portion of the Hanford Reservation along the east bank of the Columbia River (see Figure 4). The site appears to be generally level with sand and gravel exposed at the surface. A large irrigation ditch with an estimated flow of 20 cfs transects the site. The proposed acclimation facility will blend ground water with surface water from either the river or the irrigation ditch. We understand the amount of ground water used will depend entlrely upon the resource available.

## REGIONAL HYDROGEOLOGY

Sedimentary deposits of the Ringold Formation are exposed along the valley slopes at the White Bluffs site. The Ringold Formation typically includes upper and lower fine-grained units of silt, silty sand and clay, with an intermediate unit of cemented gravel. The base of the Ringold consists of a thick sequence of silt and clay. Glacial floods and the Columbia River have incised the Ringold thus exposing the uppermost silt and silty sand unit in White Bluffs. The coarser sand and gravel unit is also exposed along the base of White Bluffs; the gravel unit is believed to extend to a depth of approximately 150 feet beneath the site.

A sequence of coarse sand and gravel deposited along the valley floor by glacial floods and the Columbia River cap the sand and gravel unit of the Ringold. The thickness of this unit is unknown. These upper sand and gravel deposits are probably hydraulically connected to the Columbia River and have a good potential for sustaining several high yield wells.

Underlying the silt and clay base of the Ringold is the Saddle Mountains subgroup of the CRBG. Aquifers within the CRBG are capable of producing large quantities of water; however, high ground water temperatures may preclude the use of water from wells completed in the basalt.

Bottom-hole temperature for wells in the White Bluffs area are plotted ver; us bottom-hole depth in Figure 5. The temperature data suggest that the 20 degrees Celsius isotherm occurs approximately 300 feet below ground surface. This depth is likely to occur in the upper lava flows of the CRBG.

## RECOFfMENDATIONS

Hydrologic information for the White Bluffs site is widely spaced and distant. The closest water well (T14NR26E-14) constructed in the Ringold sediments is located approximately five miles upstream. This well has a low yield (see Table 2) ; however, its specific capacity is high, indicating a potential for a shallow, large-volume ground water supply. Our interpretation of available information suggests that at least 1 cfs of ground water can be withdrawn from shallow depths at the White Bluffs site. We recommend drilling a 10- to 12-inch-diameter test well to an approximate depth of

200 feet. We anticipate that the hydrologic and chemical characteristics of both the flood gravels and coarse sediments of the Ringold can be tested by installation of the well.

## COST ESTIMATE

The following cost estimate should be considered as approximate because of the relatively uncertain nature of the hydrogeological conditions that will be encountered during test well construction. Costs may also vary with the time of well construction due to variable demand for drilling services and fluctuations in costs for well materials.

We estimate the cost of construction and pump testing of a 200-foot-deep test well at White Bluffs will range from $13,000 to $15,000. A 500-foot well in Walla Walla would cost approximately $29,000. We further estimate that costs for observing well construction, pump testing activities,,analyzing the pump test data, and providing design parameters for production wells will range between $7,000 to $9,000. These estimated costs do not include provisions for difficult access conditions.

## SUMMARY AND CONCLUSIONS

The potential for developing a ground water supply at both sites appears favorable. We recommend that a test well be completed at each site prior to finalizing plans for the acclimation facility. We also recommend that a qualified geohydrologist from our staff be present during drilling to keep a detailed record of the boring, and to analyze pump test data while on si te. We anticipate the test well on either site will be used as a production well to supply the acclimation facility.

Washington State law requires water rights to be secured for ground water withdrawals exceeding 5000 gallons per day (WAC 173-160-040). We have not investigated the current ground water appropriations for these areas and recommend that the water rights be secured before further exploration of the sites.

## USE OF THIS REPORT

We have prepared this report for use by Sverdrup Corporation and by the U.S. Fish and Wildlife Service. Our recommendations are based on a review of available hydrogeologi data and considerable judgment. Although the ground water supply potential appears promising at both sites, our interpretations should not be construed as a warranty of subsurface conditions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No other conditions, express or implied, should be understood.

0 0 -

We appreciate the opportunity to be of service. Please call if you have any questions regarding our report.

Respectfully submitted,

GeoEnglneers, Inc.


Scott E. Widness/by JAm

Scott E. Widness
Geological Engineer/Hydrologist

James A. Miller

Jamees A. Miller
Principal

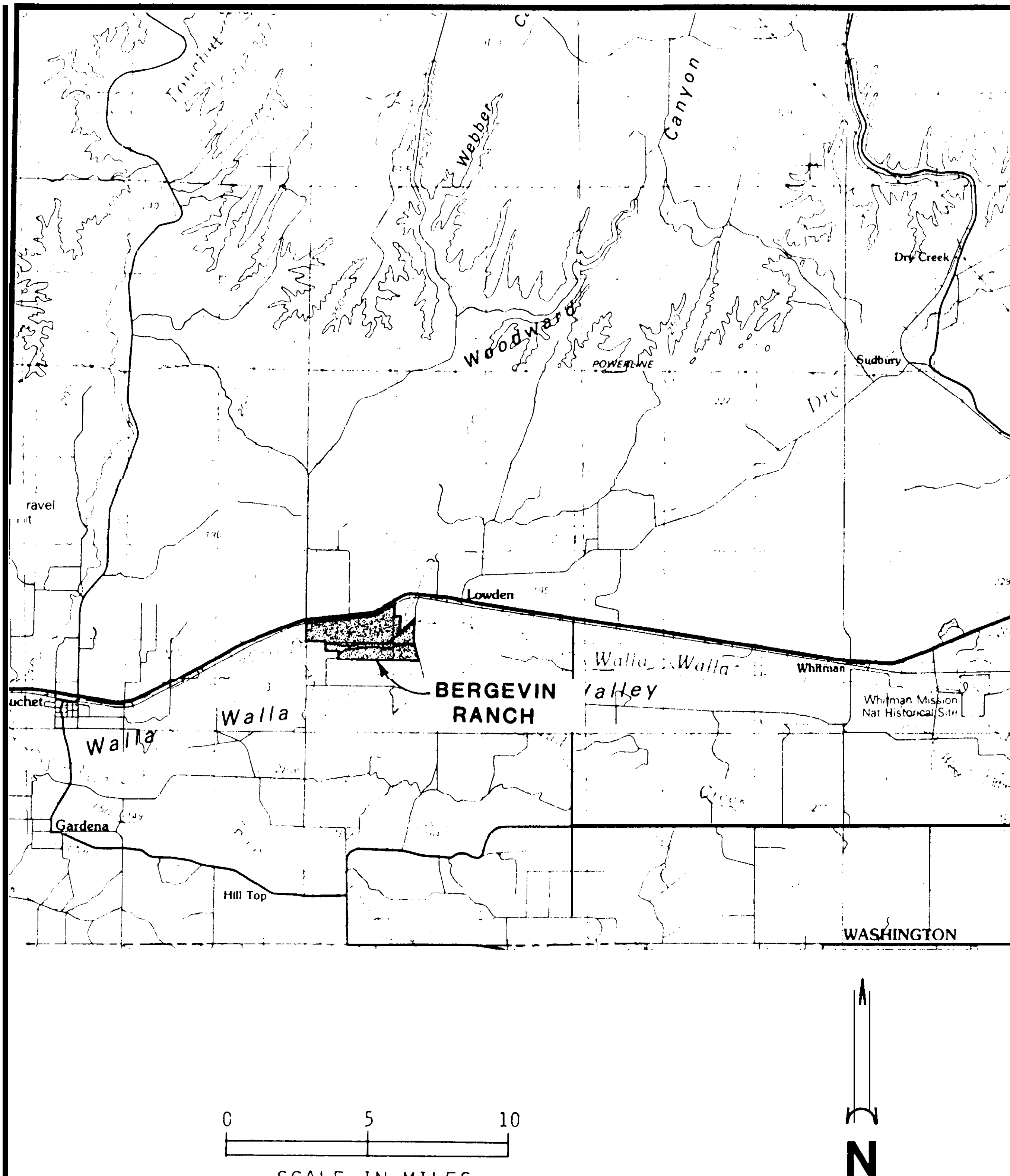
SEW:JAM:cs

TABLE 1 SUMMARY OF WATER WELL DATA - BERGEVIN RANCH, WALLA WALLA, WA

| WELL NUMBER (TN/RG-SEC) | DEPTH (FEET) | DEPTH TO STATIC WATER LEVEL (FEET) | YIELD (GPM) | SPECIFIC CAPACITY (GPM/FT. /FT. OF DRAWDOWN) | AQUIFER | TEMPERATURE (CELCIUS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| 6N/33E-1F | 979 | - | - | - | BASALT | 31.8 | |
| 6N/33E-10H | 295 | | - | - | - | 16.4 | |
| 6N/34E-2B | 563 | 22 | - | - | BASALT | | |
| 6N/34E-6B | 1508 | 135 | - | - | BASALT | | |
| 6N/34E-7K | 1307 | - | - | - | BASALT | 28.8 | |
| 6N/35E-18A | 1305 | 164 | - | - | BASALT | 28.7 | |
| 7N/33E-24Q | 1392 | 108 | - | - | BASALT | 23.2 | |
| 7N/33E-31K | 863 | 105 | - | - | BASALT | 27.7 | |
| 7N/34E-25N | 1102 | 22 | 442 | 6.5 | BASALT | 20.0 | |
| 7N/34E-27L | 87 | 6 | 315 | 8.9 | GRAVEL | - | |
| 7N/34E-28A | 36 | 10 | 225 | 18.8 | GRAVEL | - | |
| 7N/34E-28B | 88 | 34 | 164 | 10.3 | GRAVEL | - | |
| 7N/34E-28C | 36 | 12 | 235 | 14.7 | GRAVEL | - | |
| 7N/34E-28E | 127 | 34 | 250 | 4.5 | GRAVEL | | |
| 7N/34E-28K | 85 | 14 | - | - | GRAVEL | 16.7 | CLAUS BERGEVIN WELL |
| 7N/34E-29C | 1201 | 75 | 1056 | 75.4 | BASALT | - | |
| 7N/34E-29E | 20 | 6 | 200 | 14.3 | GRAVEL | - | |
| 7N/34E-29F | 23 | 10 | 118 | 9.8 | GRAVEL | - | |
| 7N/34E-29H | 260 | 114 | 75 | 0.9 | BASALT | 14.4 | |
| 7N/34E-31C | 117 | 15 | 75 | 1.5 | GRAVEL | 8.9 | |
| 7N/34E-31D | 120 | 7 | 100 | 1.9 | GRAVEL | - | |
| 7N/34E-31E | 16 | 9 | 20 | 5.0 | GRAVEL | 12.8 | |
| 7N/34E-31Q | 100 | 8 | 160 | 4.0 | GRAVEL | - | |
| 7N/34E-31R | 21 | 11 | 115 | 16.4 | GRAVEL | - | |
| 7N/34E-32D | 16 | 8 | 30 | 6.0 | GRAVEL | - | RUSSEL BERGEVIN WELL |
| 7N/34E-32L | 16 | 5 | 100 | 16.7 | GRAVEL | 7.2 | |
| 7N/34E-33E1 | 115 | 4 | 525 | 32.8 | GRAVEL | 12.2 | |
| 7N/34E-33E2 | 155 | 6 | 400 | 4.7 | GRAVEL | 16.7 | |
| 7N/34E-33G | 99 | 7 | 500 | 38.5 | GRAVEL | - | |
| 7N/34E-33J | 68 | 2 | 200 | 15.4 | GRAVEL | - | |
| 7N/34E-34E1 | 154 | 10 | 190 | 1.5 | GRAVEL | - | |
| 7N/34E-34E2 | 144 | 7 | 340 | 7.7 | GRAVEL | - | |
| 7N/34E-34J | 147 | 6 | 130 | 1.1 | GRAVEL | - | |
| 7N/34E-34N | 115 | 10 | 75 | 0.8 | GRAVEL | | |
| 7N/34E-35J | 155 | 6 | 400 | 4.8 | GRAVEL | - | |
| 7N/34E-35R | 85 | 17 | 40 | 0.8 | GRAVEL | - | |
| 7N/34E-36L | 107 | | - | | GRAVEL | 13.4 | |
| 7N/35E-25A | 852 | - | - | - | BASALT | - | |
| 7N/35E-25B | 230 | - | - | | | 12.7 | |
| 7N/35E-33H | 697 | - | - | | BASALT | 24.0 | |
| 7N/35E-34L | 704 | 88 | - | | BASALT | 24.0 | |
| 7N/35E-35A | 1017 | | - | - | BASALT | 20.5 | |
| 8N/33E-21Q1 | 620 | 530 | LOW | - | BASALT | 17.1 | |
| 8N/33E-21Q2 | 935 | | LOW | - | BASALT | 23.7 | |

TABLE 2 SUMMARY OF WATER WELL DATA - WHITE BLUFFS, WA

| WELL NUMBER (TN/RG-SEC) | DEPTH (FEET) | DEPTH TO STATIC WATER LEVEL (FEET) | YIELD (GPM) | SPECIFIC CAPACITY (GPM/FT. /FT. OF DRAWDOWN) | AQUIFER | TEMPERATURE (CELCIUS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| 12N/26E-4N | 376 | - | - | - | - | 21.4 | |
| 12N/26E-7B | 404 | - | - | - | - | 20.7 | |
| 12N/26E-7Q | 317 | - | - | - | - | 20.4 | |
| 12N/26E-8P | 315 | - | - | - | - | 21.2 | |
| 12N/26E-12F | 507 | - | - | - | - | 21.0 | |
| 12N/26E-14D | 376 | - | - | - | - | 21.1 | |
| 12N/26E-15C | 430 | - | - | | - | 21.7 | |
| 12N/26E-18E | 568 | - | - | - | - | 20.5 | |
| 12N/26E-18G | 273 | - | | | - | 20.8 | |
| 12N/26E-29G | 830 | 170 | 450 | 1.9 | BASALT | 24.4 | |
| 12N/27E-16K | 209 | - | - | - | - | 20.5 | |
| 12N/29E-28K | 684 | - | | | - | 20.0 | |
| 13N/25E-1N | 774 | - | - | - | - | 23.0 | |
| 13N/25E-6R | 60 | 48 | 58 | 8.7 | GRAVEL | - | |
| 13N/25E-7 | 93 | 61 | 250 | 125 | GRAVEL | - | |
| 13N/25E-11J | 103 | - | - | - | - | 39.1 | |
| 13N/25E-30G | 1110 | +190 | 1375 | 1375+ | BASALT | - | 82 PSI SHUT IN PRESSURE |
| 13N/26E-25 | 587 | - | - | - | - | 21.9 | |
| 13N/26E-26 | 250 | 110 | - | - | GRAVEL | - | |
| 13N/26E-35G | 5541 | - | - | | BASALT | 25.0 | |
| 13N/27E-16 | 84 | 51 | 265 | 133 | GRAVEL | | |
| 13N/28E-13N | 1095 | - | - | - | - | 27.6 | |
| 14N/26E-14K | 77 | - | - | - | - | 32.5 | |
| 14N/25E-1D | 915 | | | - | - | 27.5 | |
| 14N/25E-17L | 65 | 15 | 10 | 0.5 | GRAVEL | - | |
| 14N/25E-21B | 510 | | - | - | - | 22.0 | |
| 14N/26E-14 | 48 | 38 | 17 | 32 | GRAVEL | 15.6 | |
| 14N/26E-28E | 77 | - | - | - | - | 20.7 | |
| 14N/27E-24B | 1368 | - | - | - | - | 30.0 | |
| 14N/29E-9A1 | 844 | - | - | - | - | 22.3 | |
| 14N/29E-9A2 | 690 | - | - | - | - | 22.2 | |

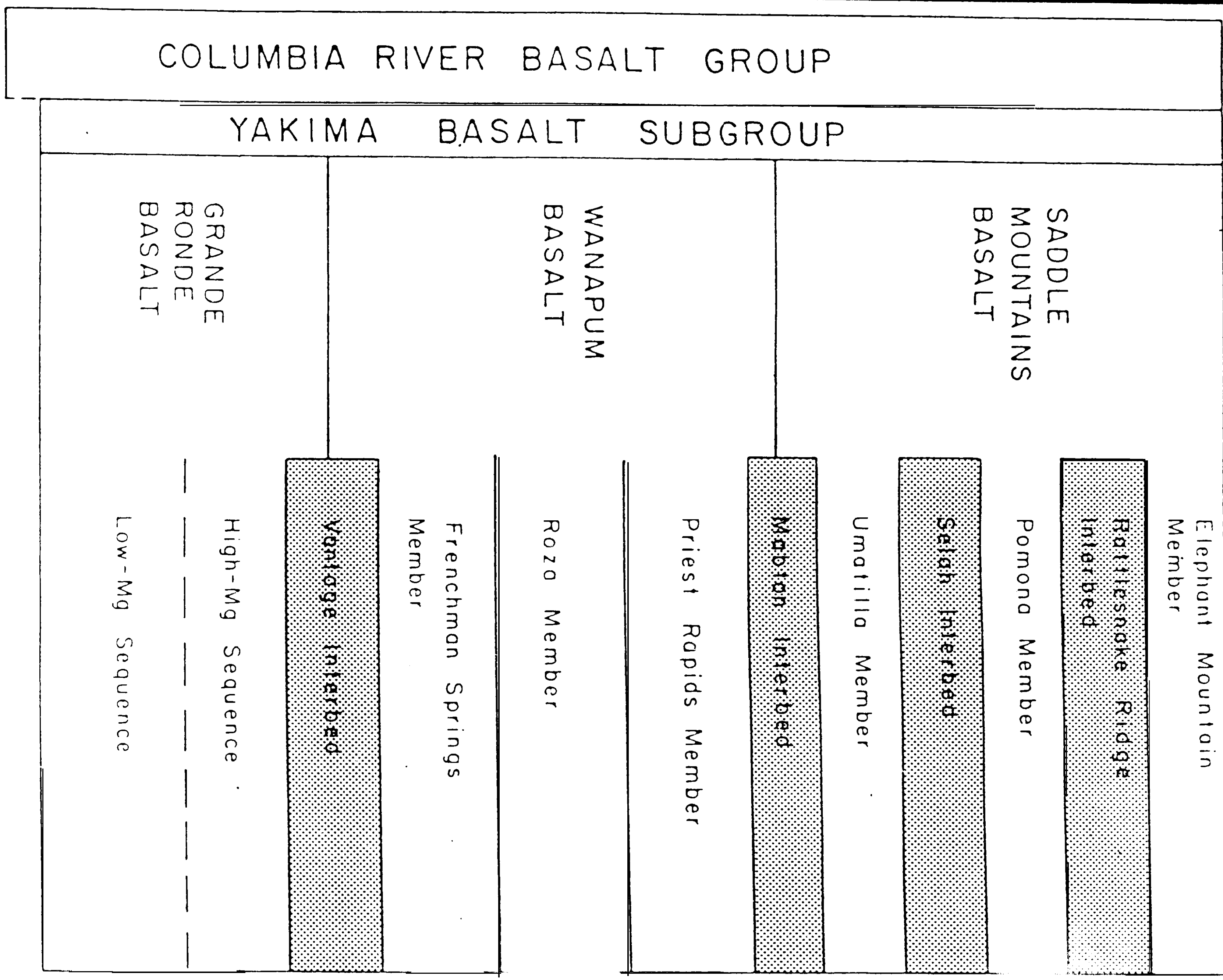



REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAP (SCALE 1:100,000).
"WALLA WALLA, WASHINGTON/OREGON".

GeoEngineers Incorporated

**VICINITY MAP - WALLA WALLA**

**FIGURE 1**




GeoEngineers Incorporated

STRATIGRAPHIC RELATIONSHIP AND NOMENCLATURE

FIGURE 2

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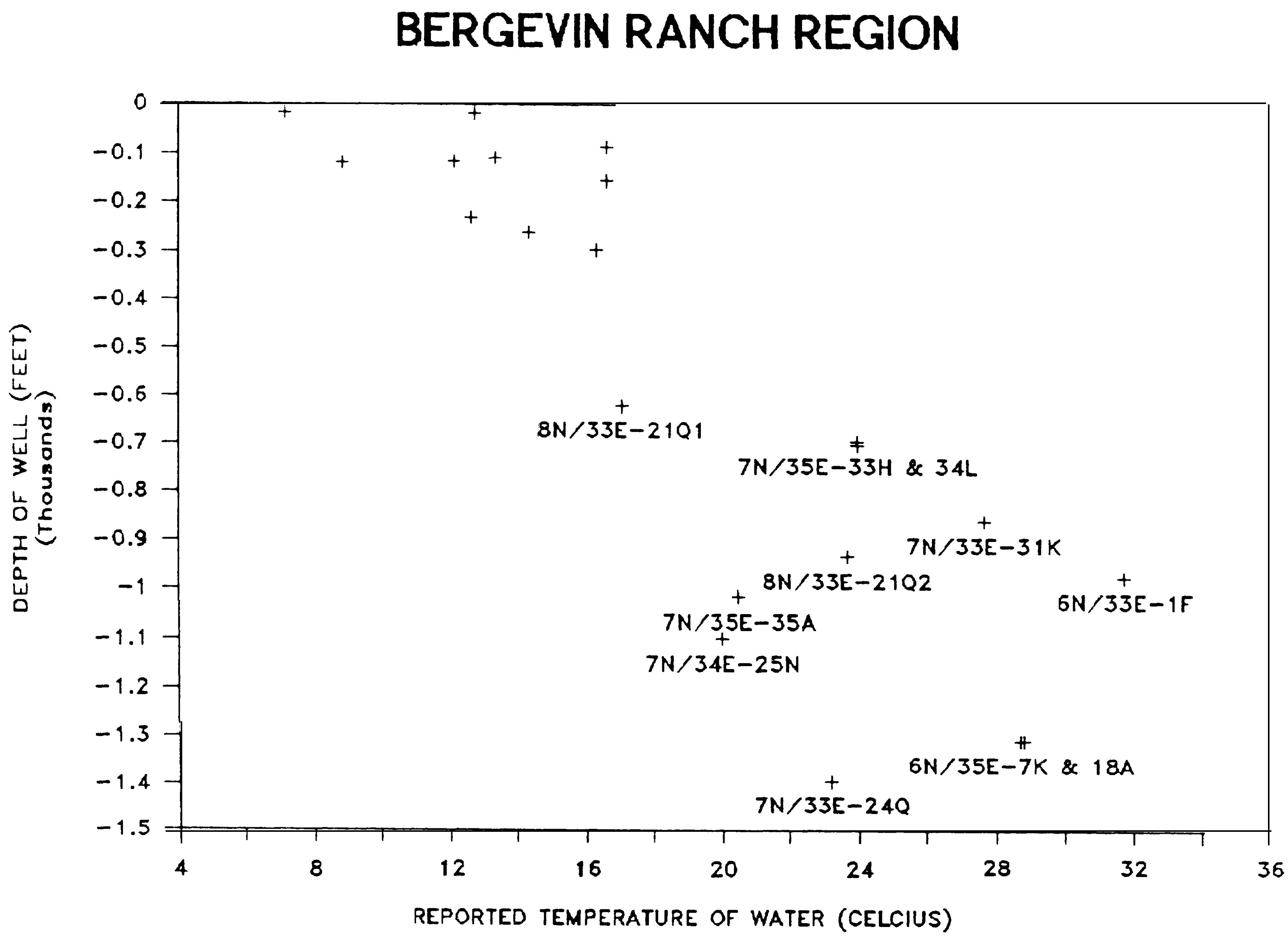
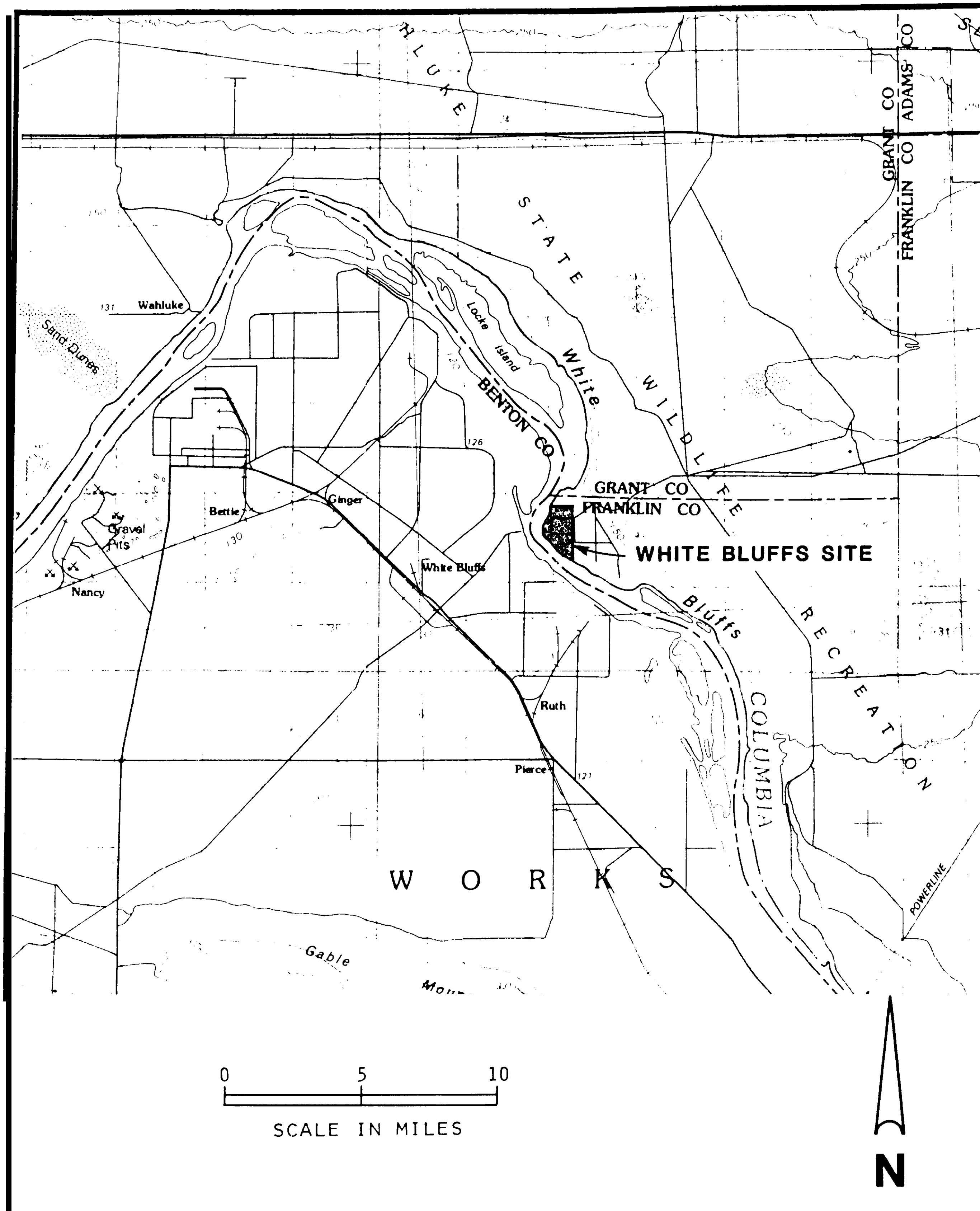



GROUND WATER TEMPERATURE - WALLA WALLA

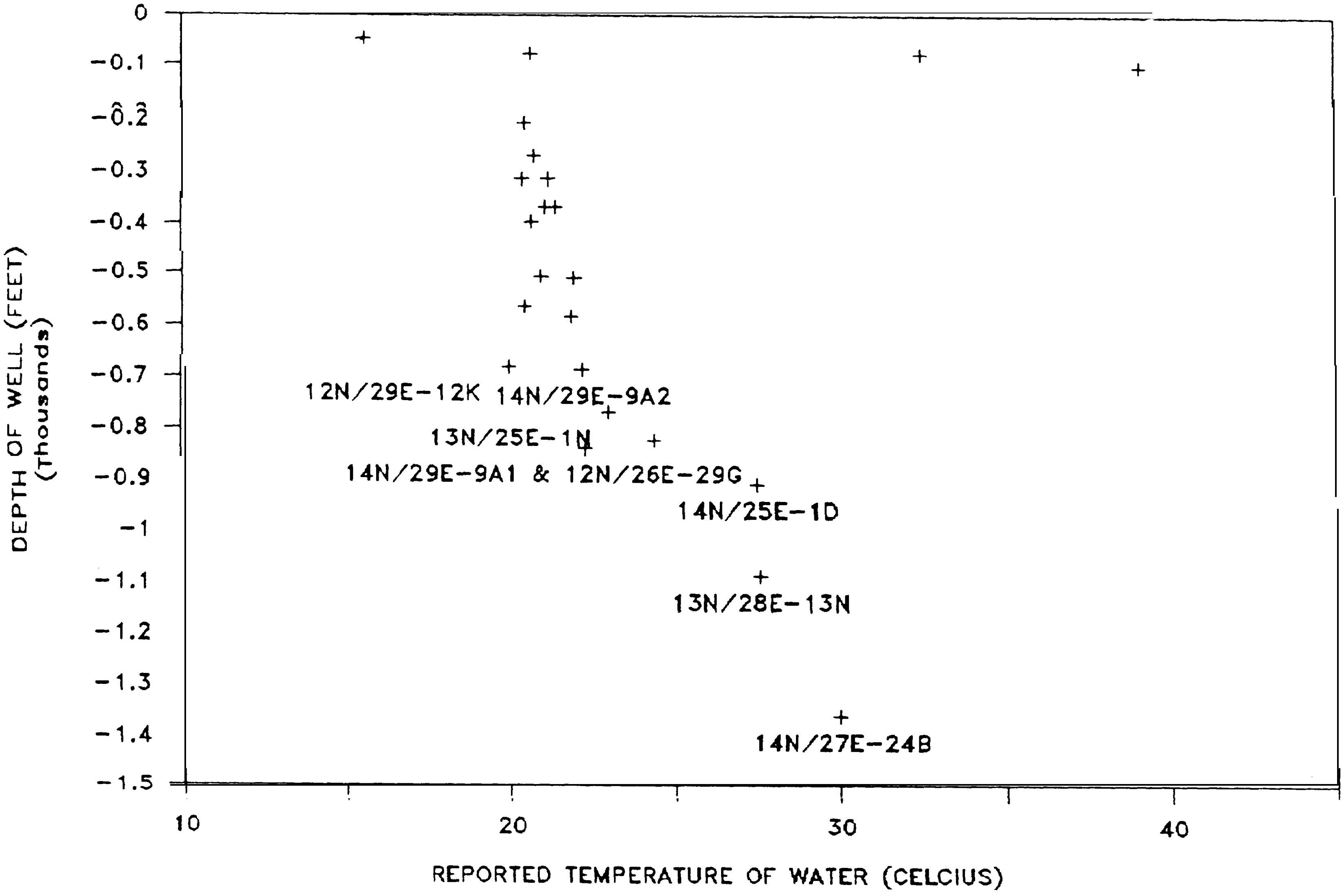
FIGURE 3




REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAP (SCALE 1:100,000), "PRIEST RAPIDS, WASHINGTON."

| GeoEngineers Incorporated | VICINITY MAP - WHITE BLUFFS |
| --- | --- |
| | FIGURE 4 |

# WHITE BLUFFS REGION

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GROUND WATER TEMPERATURE - WHITE BLUFFS

FIGURE 5

# APPENDIX D

# WATER QUALITY RESULTS

am test inc.

14603 N.E. 87th St. • REDMOND, WASHINGTON 98052 • 206/885-1664

ANALYSIS REPORT

CLIENT: Sverdrup Corporation

DATE RECEIVED: 5/20/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 5/29/87

| Laboratory Sample Numbers | 705567 | 705568 | 705569 |
|---|---|---|---|
| Client Identification | Sunnyside | White Bluffs WB River | WB Wastewater |
| Alkalinity (mg/l as $CaCO_3$) | 37. | 59. | 237. |
| Chloride (mg/l) | 2.8 | 3.3 | 31. |
| Ammonia - Nitrogen (mg/l) | 0.048<br>0.051 [3] | 0.095 | 0.023 |
| Nitrate + Nitrite (mg/l) | 0.720 | 0.500 | 0.690 |
| Nitrite (mg/l) | 0.005 | 0.004 | 0.001<br>0.001 [1] |
| Dissolved Oxygen (mg/l) | 12.10 | 12.30 | 7.35 |
| Total Suspended Solids (mg/l) | 4. | 27. | 9. |
| Settleable Solids (mg/l) | <0.1 | 0.1 | 0.1 |
| Total Kjeldahl Nitrogen (mg/l) | (0.200 | 0.833 | 0.550 |
| Total Dissolved Solids (mg/l) | 143. | 132. | 482. |
| PH | 8.0 | 8.1 | 8.9 |
| Copper (mg/ 1) | 0.004 | 0.007<br>0.005 [1] | 0.001 |
| Zinc (mg/1) | 0.013 | 0.060<br>0.060 [1] | 0.048 |

REPORTED BY John T. Dailey
John Dailey

JD/pb

# JOHN DAY FALL CHINOOK/SALMON MITIGATION PLAN
# ACCLIMATION AND IMPRINTING
# SITE FEASIBILITY STUDY
# HAT ROCK SITE

Completion Report

by

U.S. FISH AND WILDLIFE SERVICE
Portland, Oregon

and

SVERDRUP CORPORATION
Bellevue, Washington

Funded by

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
DIVISION OF FISH AND WILDLIFE
CONTRACT NO. 14-16-0001-84078
PROJECT NO. ________

September 1987

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## APPENDICES

# I INTRODUCTION

The Hat Rock Park area is one of 10 locations being considered for an acclimation facility as part of the John Day Fall Chinook Salmon Mitigation Plan. This report presents results from an engineering feasibility study of the Hat Rock site.

# II SITE INFORMATION

A. Location

Hat Rock is part of the Oregon Hat Rock State Park on U.S. Highway 730, 8 miles northeast of Hermiston, Oregon on the south bank of the Columbia River. The park contains approximately 732 acres within Sections 14 and 15, Township 5 North, Range 29 East. Adjacent to the park are privately owned residential areas, a small boat harbor, and yacht club facilities. Figure 1 is a Location Map and Figure 2 is a Vicinity Map for Hat Rock.

B. Land Ownership

Park land is leased to the State of Oregon by the Federal Government. The Federal Government also owns land adjacent to the park on both the east and west. Land ownership information and property maps are in Appendix B.

C. Site Description

A prominent feature of the park is Hat Rock Pond, which is a spring-fed backwater of the Columbia River McNary Pool. It appears that most spring flow enters at the upstream end: However, there also could be submerged springs throughout the pond. The pond is subdivided by a dike with culverts and the upstream portion is used for a put-and-take rainbow trout fishery. The downstream portion has a boat launching ramp with two adjacent docks. Spring flow through the culverts on April 23, 1987 was measured at approximately 9 cubic feet per second (cfs). Flow is reported to be much less at times.

The Hat Rock area land form consists of alluvial deposits over basalt bedrock with occasional basalt rock outcrops. Hat Rock and Boat Rock (located 2,000 feet to the east) are two very prominent isolated outcrops. There are also two basalt cliffs within and near the park. Elevations vary from 340 feet, which is the normal McNary Pool level, to elevation 500 on Boat Rock.

The west and southwest park boundary is the former Union Pacific Railroad right-of-way line. This railroad is abandoned and all that remains is the old road bed, which now forms a portion of the paved park entrance road. The old railroad grade crosses the park on a northeasterly bearing while the park boundary lines continue east and then north along section and traverse lines. The Columbia River and the residential property lines form the north boundary.

D. Access and Services

Access to Hat Rock Park is on a two lane paved rural road. It is approximately 1.5 miles from its junction with Highway 730 to its end at the boat launch ramp. One other paved and maintained road within the park goes to the residential subdivision and yacht club. Other unpaved and mostly closed roads exist in the more remote east portions of the park. The yacht club has fuel and there are limited goods and services available at a retail and residential area adjacent to the park entrance road. Complete services may be obtained in Hermiston.

E. Soils and Vegetation

The USDA Soil Conservation Service classes the site materials as shallow to very deep well drained soils, loamy fine sand (also very deep), and excessively drained and hard unweathered basalt bedrock outcrops. Vegetation consists of grasses and sage in dry areas and numerous large trees along the pond and upstream spring areas.

F. Flood Levels

The Columbia River and Hat Rock Pond levels are controlled primarily by McNary Dam, located roughly five miles downstream. The normal pool elevation varies from 335 feet to 340 feet as regulated by the U.S. Army Corps of Engineers. The Corps predicts a 100 year recurrence internal flood level on the Columbia at Hat Rock to be at approximate elevation 340.

G. Utilities

Hat Rock State Park and adjoining areas are served by Pacific Northwest Bell and the Umatilla Electric Cooperative, both with offices in Hermiston, Oregon. Many residences have satellite receiving dishes, indicating there is no cable TV service. Domestic and fire protection water is primarily from wells, although surface springs also may be used. There are several wells in the immediate area, all shallow (less than 120 feet) with what is reported to be moderate to high yield. Well logs and a ground water report are in Appendix C. Community wells are routinely sampled for bacteriological analysis and presumably approved by the State of Oregon for human consumption. Sewage disposal is typically via a septic tank and soil absorption system. Soils are generally highly permeable, making these septic systems quite adequate. Solid waste is disposed of by the City of Hermiston garbage collection. Trucks visit the site once a week.

## H. Cultural Resources

Three sites of archaeological interest have been identified at Hat Rock Park and more may exist. Prior to any construction activity it is recommended that detailed investigations be conducted (refer to the Cultural Resources Overview report in the Summary Report).

# III PRODUCTION GOALS

The Hat Rock sites were evaluated to determine their ability to provide acclimation and imprinting for 30,000 pounds of fall chinook salmon fry in four 7,500 pound lots. The fish, upon arrival, would be either fry at approximately 100 per pound or smolt at 20 per pound. Three different acclimation periods from 3 to 21 days plus one zero day "acclimation period" are planned. The facilities are also planned with flexibility so that different rearing programs can be used if desired.

# IV DEVELOPMENT CONCEPTS

Land based raceways or ponds, floating net pens, or rearing in the park pond appear feasible at Hat Rock. Any land based improvements will require a pumped water supply. Net pens or rearing in the park pond will have water circulation from spring flow and Columbia River flow. Each of these concepts are discussed in more detail in the following narrative. Site Plans which show each concept are in Figures 3-5. Detail drawings of concrete raceways, asphalt ponds, and floating net pens are in the Summary Report.

## A. Land Based Facility

Early in the investigations two sites which met the development criteria were identified. However, the site west of Hat Rock Pond was rejected by the Oregon Department of Transportation, Parks and Recreation Division (OP&RD) because of likely conflicts with existing park uses. (Refer to correspondence in Appendix A.) Fortunately, the remaining site, roughly 1 mile east, was a superior location. It is at a lower elevation, the land is flatter, and it is removed from the concentration of park activities. This east site, outside park boundaries, is on land owned and managed by the Federal Government. Access would be on an old and currently closed dirt road that crosses park property. The OP&RD has given preliminary approval to use this road for facility access. It is roughly 5,600 feet long and only minor grading and widening is necessary to make it serviceable.

As at the other sites, either eight concrete raceways or four asphalt or membrane lined ponds are proposed. Also included are an office/residence, a fish food freezer/preparation building, a fish ladder with provisions for adult capture, holding and spawning, the security fencing.

As mentioned, facility water supply would be pumped. One to 2 cfs of ground water mixed with 13 to 14 cfs of river water is required for the production goals. Ground water is needed for imprinting and river water is used because of cheaper pumping costs and lower temperatures. There is good potential for a low yield, shallow well at the project site. However, prior to any final design work, more detailed ground water hydrology studies (including construction of a test well) are required (refer to Report of Ground was Resource Evaluation Willow Creek and Hat Rock Acclimation Facilities, Gilliam Counties, Oregon May 1987 by GeoEngineers, Inc. in Appendix C).

The well would probably be 150 feet deep and require a 50 horsepower pump for 2 cfs. The discharge pipeline would be 8 or 10 inches in diameter. The river water pump station would be a pile supported structure built a short distance into the river close to the facility. It would require approximately 60 horsepower to pump 14 cfs. The design recommendation is for three - 20 horespower pumps, each capable of pumping 6 cfs. More information on the river water pump station, including conceptual level design drawings, is in the Summary Report.

B. Floating Net Pens

This concept calls for six-12 by 12 by 5 meter net pen cages anchored downstream from the existing Hat Rock Pond dike. Flow from the springs and Columbia River eddy currents in this area are felt to be adequate for oxygen supply, waste removal, and imprinting.

The OP&RD has been contacted regarding this proposal and has not rejected the idea. However, the agency is concerned about appearance and conflicts with park use. A possible compromise would be an agreement to remove the net pens by June 1 each year and leave the anchorage system with attached mooring buoys for public use. From correspondence and discussions with OP&RD, it is evident that the office/residence and fish food storage building will have to be located off park property. A likely location for these is the mobile home community just outside the park boundaries. Fish food could be prepared there and transported by vehicle to a boat at the boat launching ramp dock. A disadvantage is that the manager would not be present at all times to provide security.

The adult capture, holding, and spawning facility used with the net pen rearing would be constructed at the existing dike. It would consist of a fish ladder through the dike that would lead retruning adults to sorting and holding pens built on a gravel pad in Hat Rock Pond. The pens would consist of pipe picket fences that could be removed when not in use. There would be a new culvert will slide gate to allow the pond level to be lowered slightly for spawning operations. The existing culverts would have slide gates installed and be improved to prevent fish passage either way while the pond operates as it does now. The permanent adult capture improvements could be constructed to meet OP&RD aesthetic requirements. Figure 6 is a conceptual level detail drawing.

C. Pond Rearing

This concept would subdivide the Hat Rock Pond upstream from the dike with three fine mesh nets from shore to shore. They would be supported by anchor posts with a cable stretched between. The net would hang from the cable and a heavy lead line would hold it on the bottom.

Each of the three areas created by these nets would have an approximate volume of 250,000 cubic feet. The initial 3 lots of fish at 7,500 pounds each would have a loading density of 0.03 pounds of fish per cubic foot of volume. On April 23, 1987, the flow through the pcnd was 9 cfs. If this continues through May, it will provide a flow density of 5.6 pounds of fry per gallon per minute. Fry feeding would be done with a pneumatic blower operating from an existing paved sidewalk on the east side of the pond.

The N.E. District Biologist for the Oregon Department of Fish and Wildlife was contacted to ask how this proposal would impact the existing rainbow trout program. He stated that the trout are fished heavily during March and April and that by May 1 they are mostly gone. Restocking does not occur until February. In the District Biologist's opinion, there would be no significant conflict between programs and he felt a positive benefit would result from returning chinook salmon adults.

The adult capture, holding, and spawning improvements for this concept are the same as for net pen rearing discussed above.

## V WATER QUALITY AND TEMPERATURE

Samples of well water and pond water were obtained from the Hat Rock area on April 23 and June 23, 1987, respectively. Pond water samples were taken upstream of the dike at an approximate depth of 2 feet. Well water was sampled from an outdoor faucet near the yacht club. The well is owned by Yacht Basin Water Company and is reported to have an 8 inch casing, 95 feet deep. The static water level was 36 feet below ground surface on January 7, 1964, when the well was constructed. It has a submersible pump, a hydropneumatic pressure tank, and steel piping. Water was allowed to run approximately 5 minutes before the samples were collected. All samples were taken to AM Test Inc. in Redmond, Washington for analysis. The pond water had excess concentrations of ammonia, chloride, copper, nitrate, zinc, and total dissolved solids Well water was high in ammonia, chloride, nitrate, and zinc. On June 23, 1987 the pond water temperature was 60 degrees F and the well water temperature was 56 degrees F. Complete results are shown in Appendix D.

River water samples were not taken at Hat Rock since they were collected at Three Mile Canyon. See the Water Quality and Temperature section in the Three Mile Canyon report.

# VI COST SUMMARY

Three concepts are proposed at Hat Rock. They include a shore based facility with either concrete or vinyl raceways or asphalt ponds, floating net pens, or rearing in Hat Rock Pond. Construction cost summaries, exclusive of land acquisition or professional services fees, are shown in Table 1.

- TABLE 1 -

HAT ROCK COST SUMMARY

| | Concrete Raceways | Asphalt Ponds | Membrane Ponds | Vinyl Raceways | Floating Net Pens | Remov. Nets |
|---|---|---|---|---|---|---|
| Site Preparation | $ 90,200 | $116,600 | $116,600 | $ 90,200 | | $ 58,300 |
| Ponds, Raceways, or Net Pens | 247,000 | 93,200 | 79,700 | 205,700 | $103,800 | |
| Extra for Adult Capture | - | 21,000 | 21,000 | | 50,000 | |
| River Water Pump Station | 172,700 | 172,700 | 172,700 | 172,700 | | |
| Ground Water Well | 36,300 | 36,300 | 36,300 | 36,300 | | |
| Office/Housing | 12,500 | 12,500 | 12,500 | 12,500 | 12,500 | 12,500 |
| Food Freezer/Prep. Bldg.* | 48,900 | 48,900 | 48,900 | 48,900 | 48,900 | 48,900 |
| Standby Generator | 34,600 | 34,600 | 34,600 | 34,600 | | |
| Motor Starters, Switch Gear | 11,200 | 11,200 | 11,200 | 11,200 | | |
| Electric Utility | 12,500 | 12,500 | 12,500 | 12,500 | 200 | 200 |
| Telephone Utility | 5,100 | 5,100 | 5,100 | 5,100 | 100 | 100 |
| Subtotal | 671,000 | 564,600 | 551,100 | 629,700 | 215,500 | 120,000 |
| 15% Contingency | 100,600 | 84,700 | 82,700 | 94,500 | 32,300 | 18,000 |
| Total | $771,600 | $649,300 | $633,800 | $724,200 | $247,800 | $138,000 |
| Monthly Power Cost | 3,200 | 3,200 | 3,200 | 3,200 | 226 | 226 |

* Portable Freezer Van Cost = $41,500

## VII ADVANTAGES AND DISADVANTAGES

A. The Hat Rock land based site has the following advantages and disadvantages:

- All water must be pumped.
- Approval by the Oregon, DOT, Parks Division is required.
- Land ownership is favorable.
- Good access control for security.
- Potential fish health problems.
- River water exceeds the maximum desirable concentrations of ammonia, copper, and zinc.
- Well water exceeds the maximum desirable concentrations of ammonia, chloride, copper, nitrate, zinc, and total dissolved solids.

B. The Hat Rock net pen and pond rearing sites have the following advantages and disadvantages:

- River currents and gravity flow spring water deliver oxygen and remove wastes.
- Approval by the Oregon, DOT, Parks Division is required.
- Possible conflicts with existing park uses.
- Manager residence/office and food storage not close by.
- Very poor security.
- Possible conflicts with existing rainbow trout program.
- Potential fish health problems.
- Pond water exceeds the maximum desirable concentrations of ammonia, chloride, nitrate, zinc, and total dissolved solids.

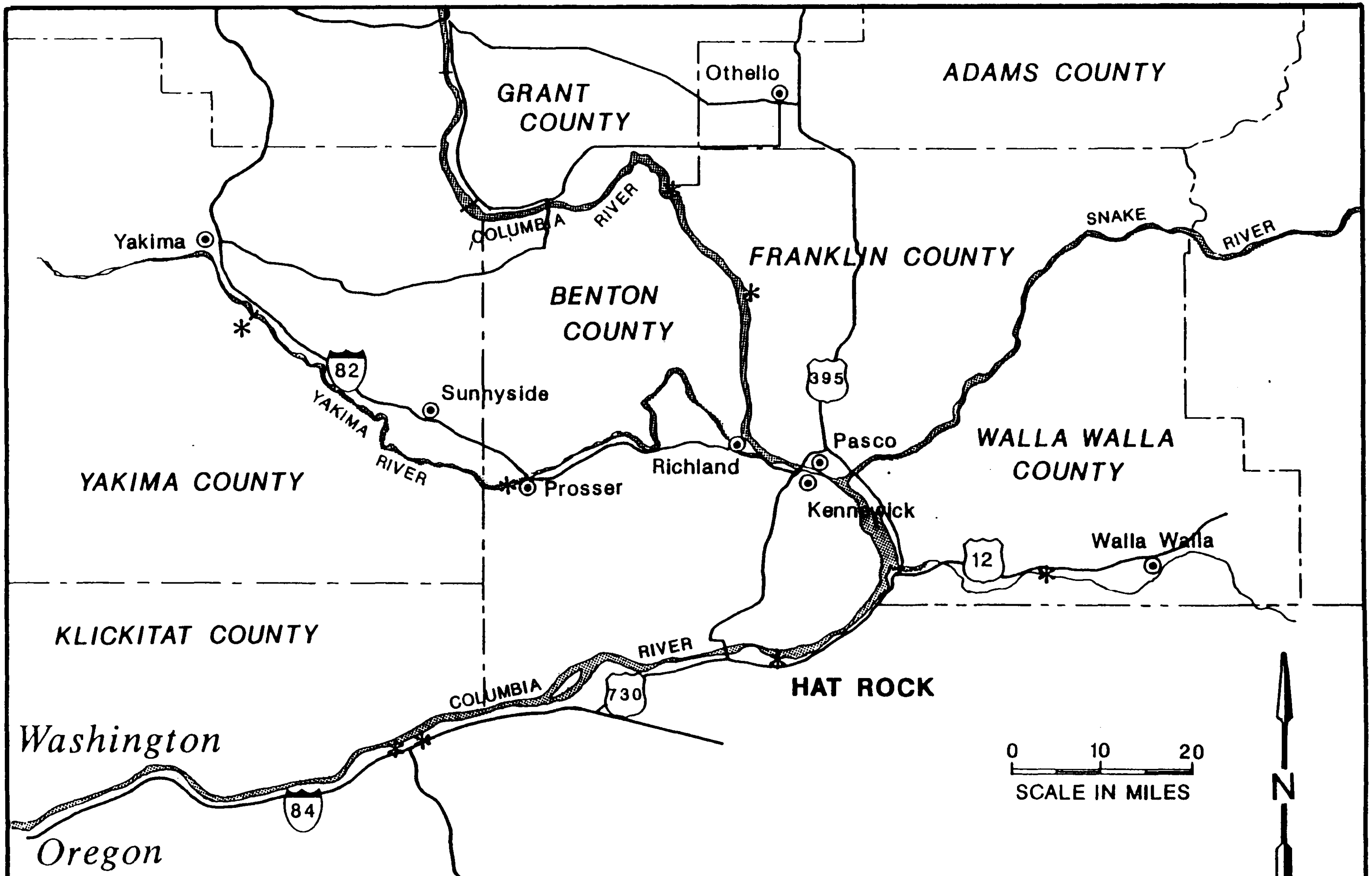
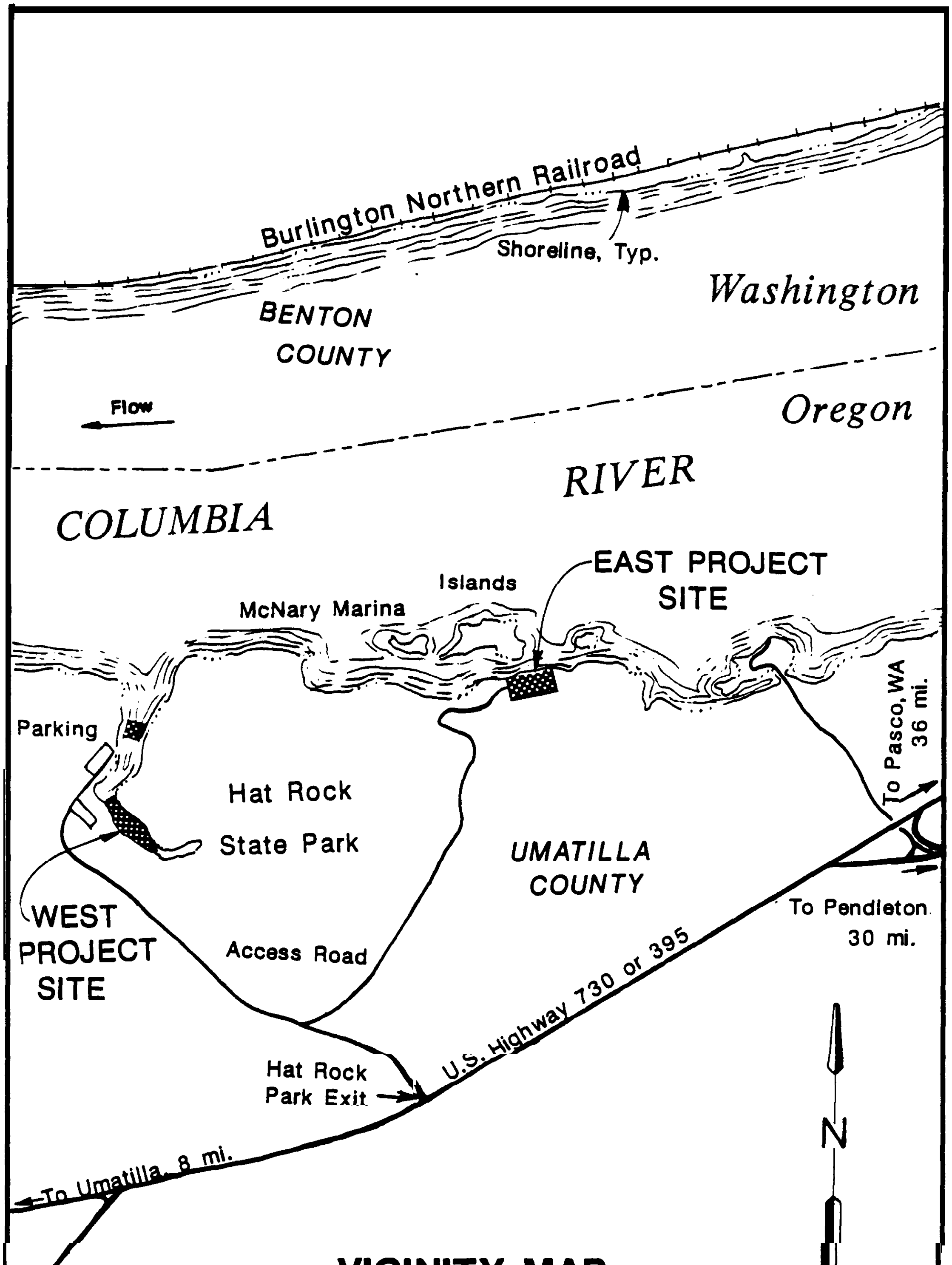



FIGURE 1

LOCATION MAP

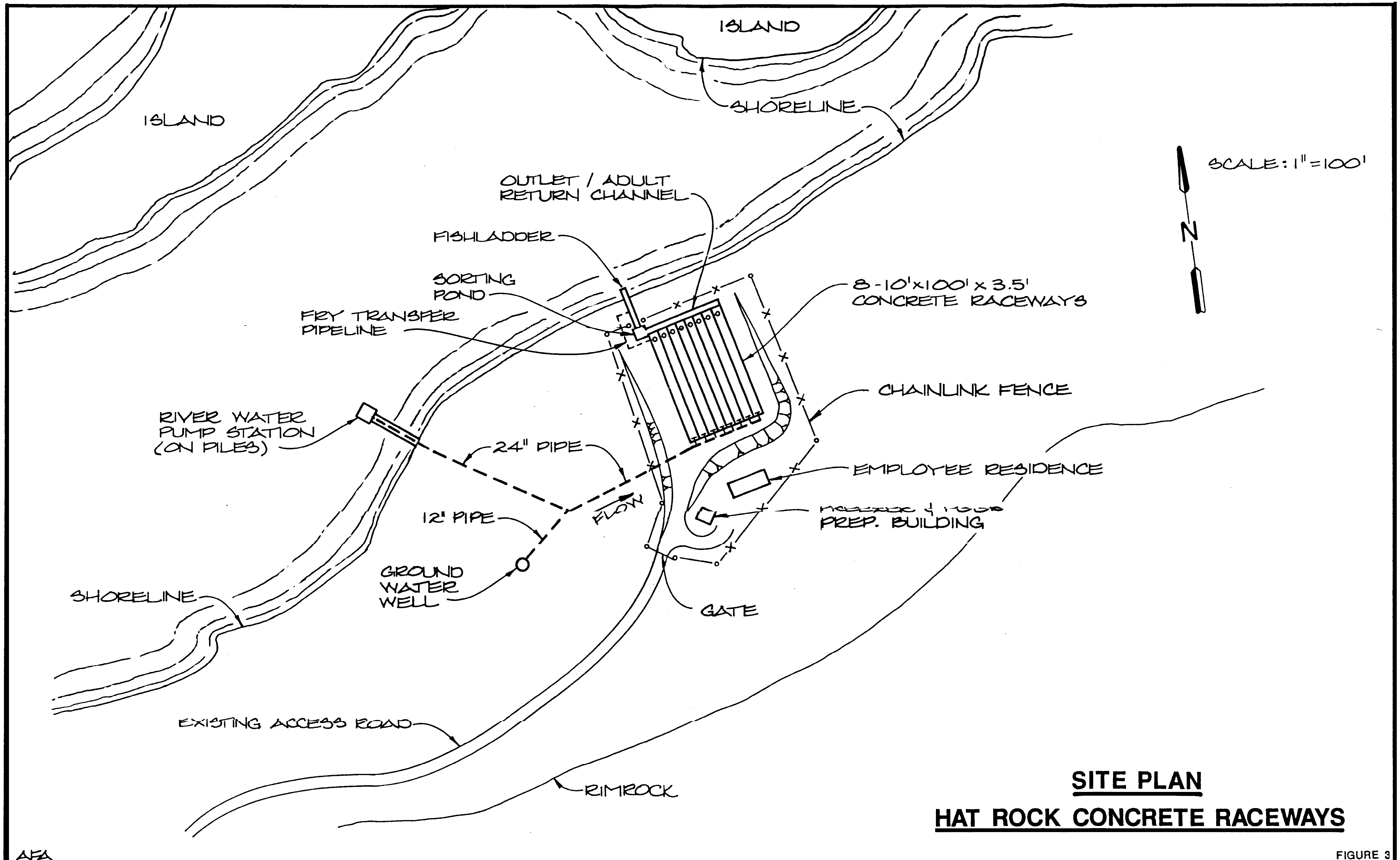



**VICINITY MAP**

**HAT ROCK**

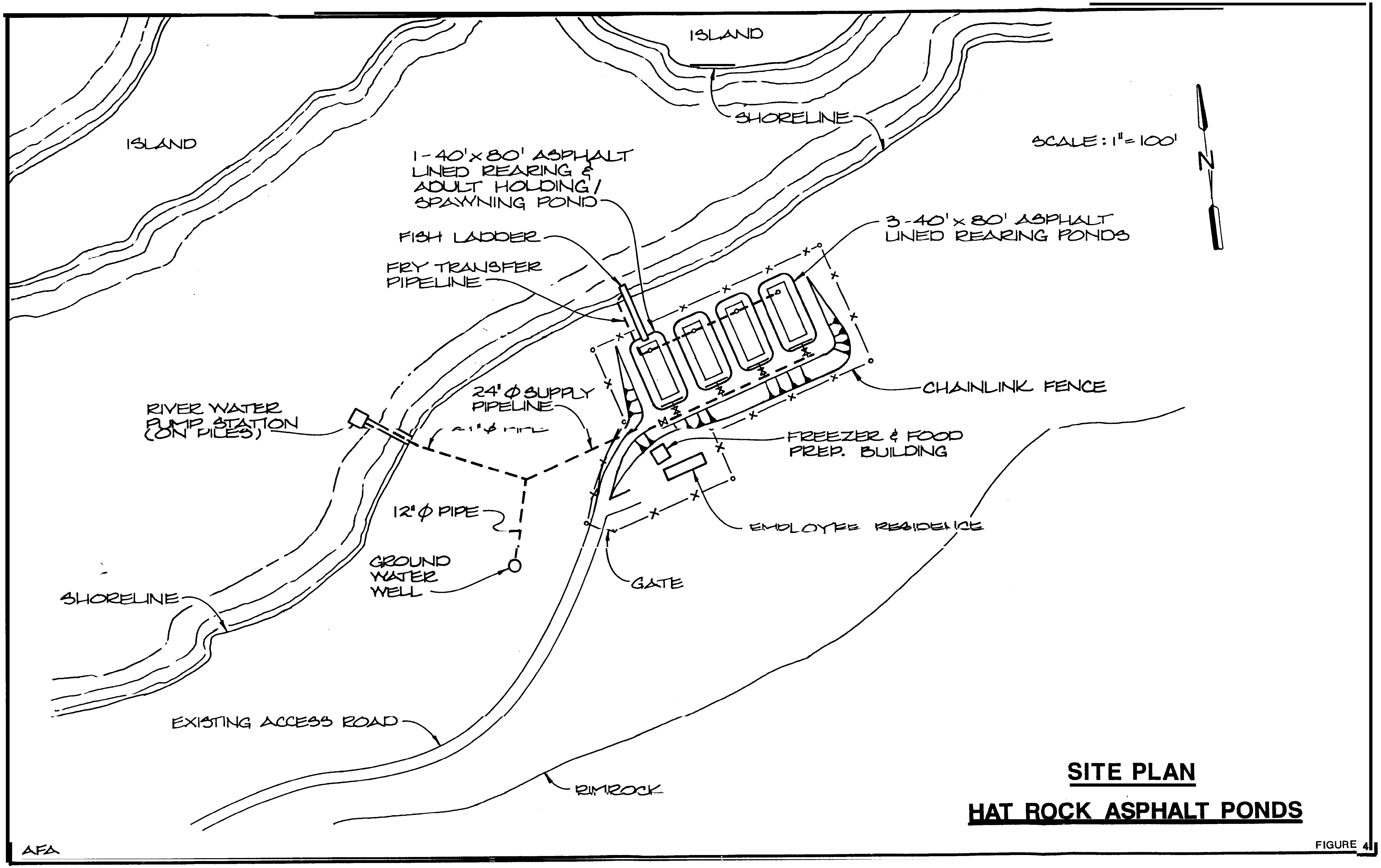
SCALE: 1"=2000'

FIGURE 2




**SITE PLAN**
**HAT ROCK CONCRETE RACEWAYS**

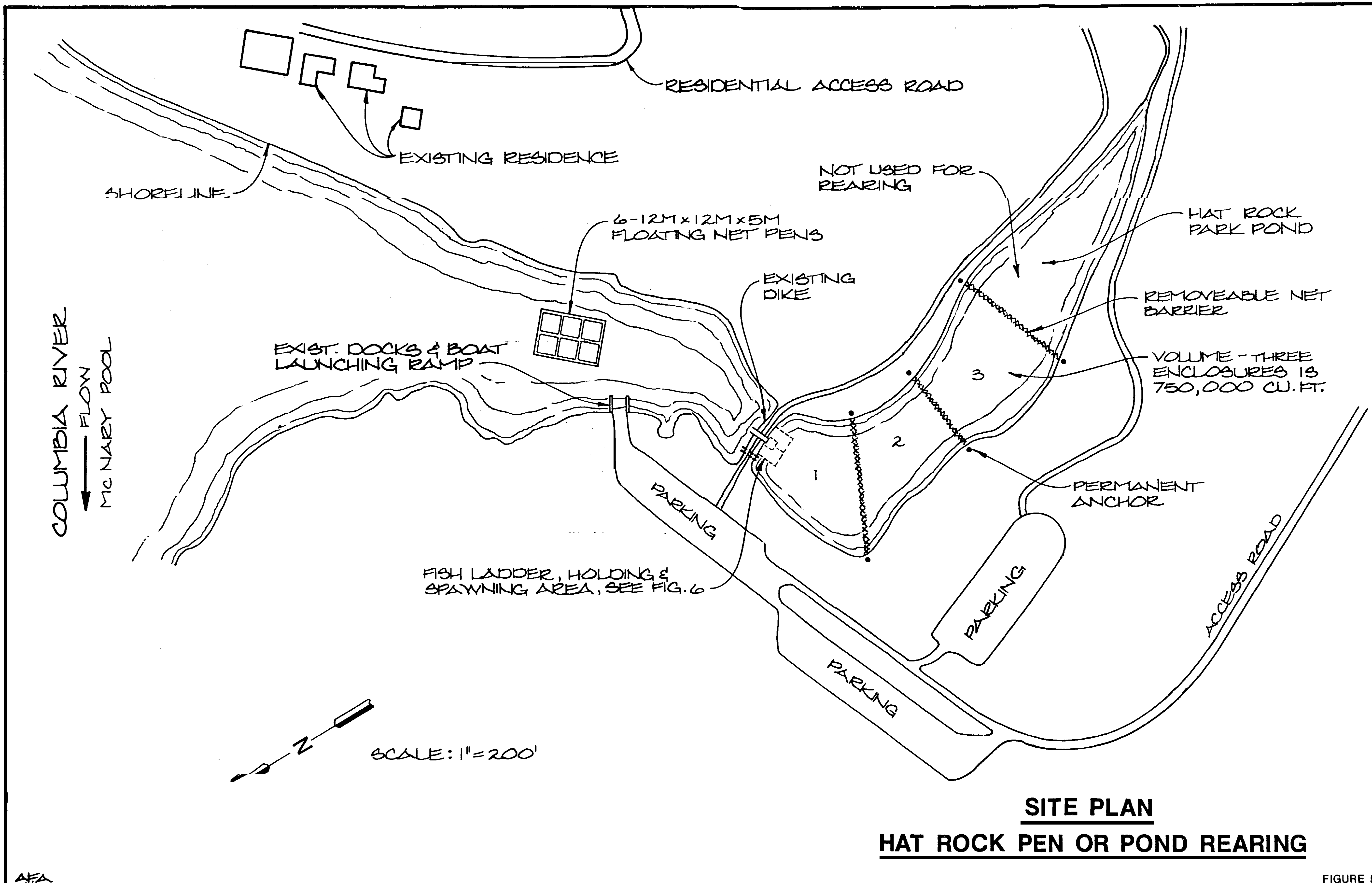
FIGURE 3




**SITE PLAN**

**HAT ROCK ASPHALT PONDS**

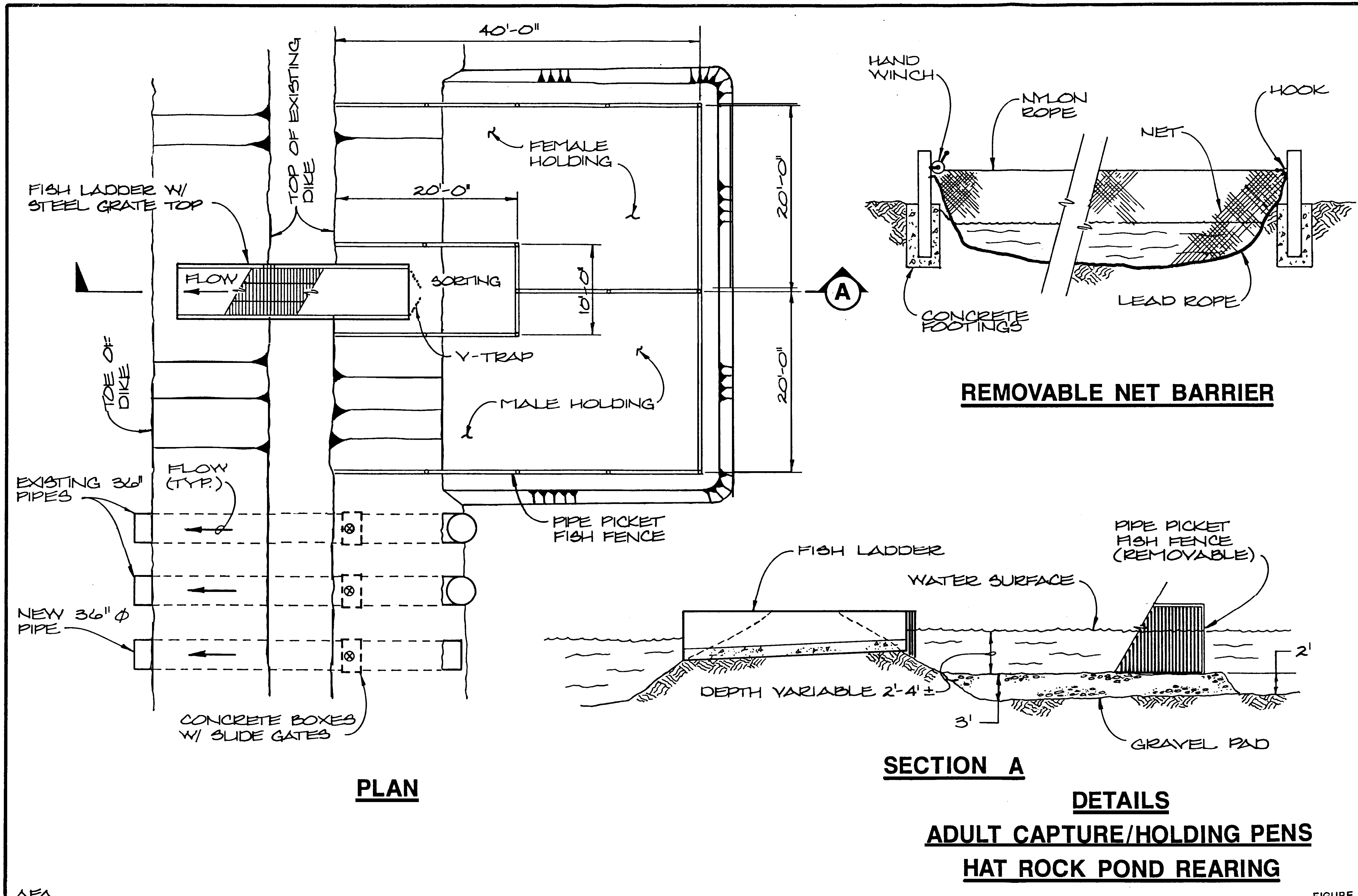
FIGURE 4




**SITE PLAN**

**HAT ROCK PEN OR POND REARING**

FIGURE 5




**DETAILS**

**ADULT CAPTURE/HOLDING PENS**

**HAT ROCK POND REARING**

FIGURE 6

# APPENDIX A

## CORRESPONDENCE

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454 9562

May 1, 1987

Oregon Department of Transportation
Division of Parks & Recreation
525 Trade Street S.E.
Salem, Oregon 97310

Attention: Mr. Dave Wright
Park Land Supervisor

Gentlemen:

Subject: Hat Rock Park

Thank you for agreeing to review our concepts for salmon fry rearing at Hat Rock State Park. As I mentioned during our telephone conversation yesterday, Sverdrup is performing a chinook salmon fry acclimation feasibility study for the U.S. Fish and Wildlife Service. Our client, the U.S. Fish & Wildlife Service and the Oregon Department of Fish and Wildlife (the facility managers), have identified several sites along the Columbia River. Hat Rock was included because of its springs, groundwater development potential, protected backwater and nearby facilities.

The enclosed sketches show concepts we have developed at three locations within the park. At the east and west sites we are considering shore based concrete raceways or asphalt lined ponds along with an employees' residence, a walk-in freezer for fish food storage, an adult capture and spawning facility, security fencing, pipelines and associated grading, etc. The residence and freezer would only be used for 6 weeks or so in the spring, and 4 weeks in the fall. During the remainder of the year they could be moved off Park property if desired. The water source at each site probably would be a combination of wells and a pumped supply from Hat Rock Pond downstream from the existing dike.

The third location considered is the Hat Rock Pond itself between the dike and river. For this site, we propose floating net pens (that rely on existing flow for water exchange) and a shore based adult capture/spawning facility, employee residence and food freezer. When adult salmon are returning they will be attracted to the adult capture with a supply of water pumped from Hat Rock Pond.

We would very much appreciate a general determination of whether or not this proposal is compatible with Park uses and your specific comments on how to make a particular concept more acceptable.

Thank you very much for your assistance. If you have questions, please phone me.

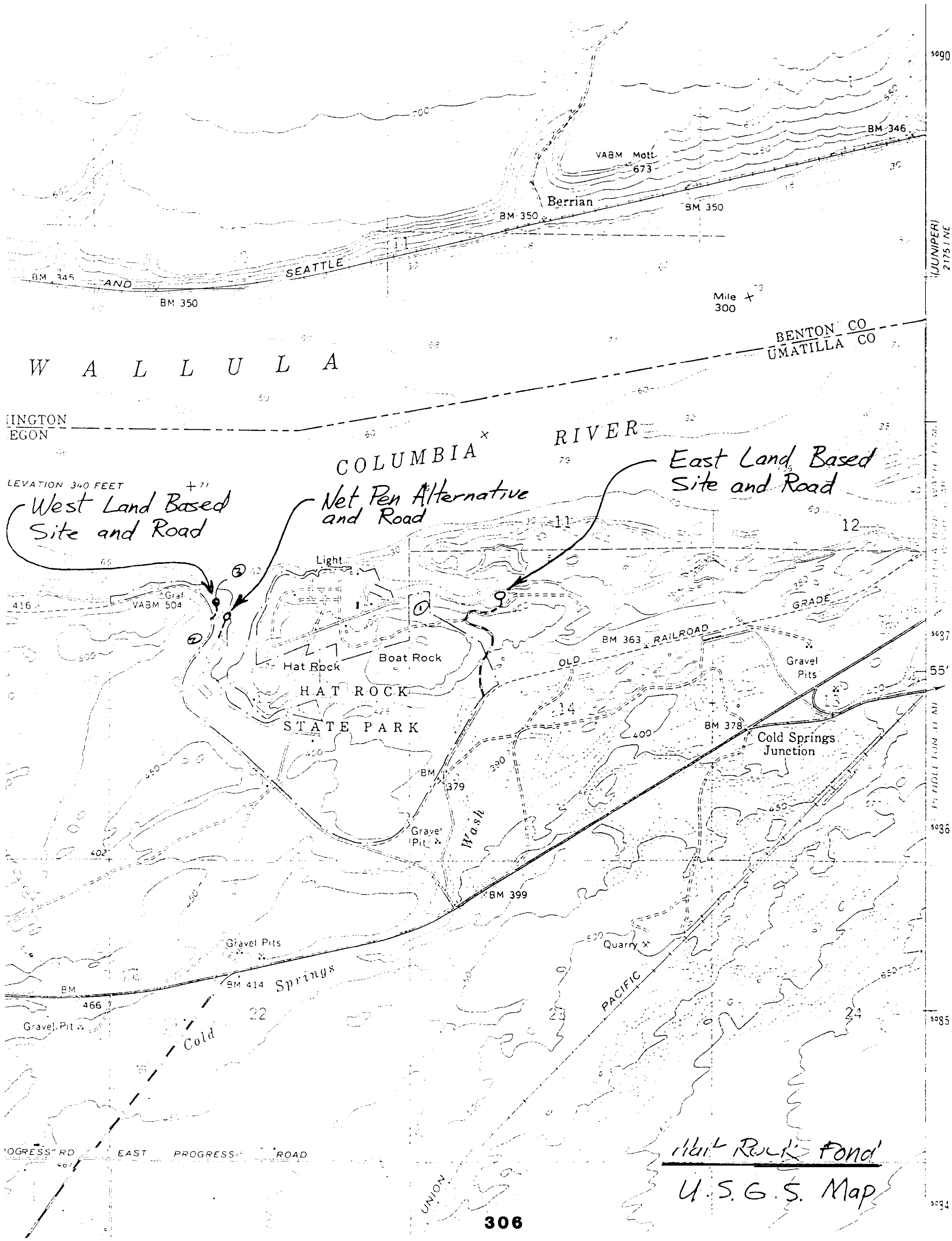
Very truly yours,

SVERDRUP CORPORATION

Harold T. Andersen

Harold T. Andersen

cc: Bill Striplin, USF&WS (w/encl.)
Harold Hansen, ODF&W (w/encl.)


West Land Based Site and Road
Net Pen Alternative and Road
East Land Based Site and Road
W A L L U L A
COLUMBIA RIVER
BENTON CO
UMATILLA CO
Berrian
SEATTLE
VABM Mott 673
Light
Hat Rock
Boat Rock
HAT ROCK STATE PARK
OLD RAILROAD GRADE
Gravel Pits
Cold Springs Junction
Wash
Gravel Pit
Quarry
PACIFIC
UNION
Cold Springs
EAST PROGRESS ROAD
Hat Rock Pond
U.S.G.S. Map

rec'd 5/13
HTA


NEIL GOLDSCHMIDT
GOVERNOR

*Department of Transportation*

PARKS AND RECREATION DIVISION

525 TRADE STREET SE, SALEM, OREGON 97310


May 14, 1987

Harold Andersen
Sverdrup Corporation
P.O. Box 369
Bellevue, WA 98009

RE: Hat Rock State Park

Dear Mr. Andersen:

The Parks Division Planning staff has reviewed your proposal relating to salmon rearing within Hat Rock State Park. Two sites you proposed and identified as the West Land Based Site and the West Net Pen Trailer Site would not be acceptable to the Parks Division. These sites are located on areas that are identified for heavy recreation use and your proposed development would not be a compatible use.

We would not rule out the East Land Based Site. This land, however, is not owned by the Parks Division. We believe it is owned and managed by the Corps of Engineers. There would be a need for access through the park in order to utilize the site. Additional information would be required with regard to the kinds of road improvements needed, frequency of road use, number of employees present, etc. before a final determination could be made.

Our planner also thought that the use of Hat Rock Pond as a water source might create problems as there is little water available from any source in that area.

I hope the above is sufficient for your current needs, Should you have additional questions, please call me at (503) 378-5010.

Sincerely,

David W. Wright
David W. Wright
Park Land Supervisor

DWW:lr
373.70

cc: Larry Jacobson
Joe Paiva
Nancy Gronowski

Sverdrup
CORPORATION

1200 112th Avenue N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 20, 1987

U.S. Fish & Wildlife Services
Lloyd 500 Building
500 N.E. Multnomah Street
Portland, OR 97232

Attention: Mr. Bill Striplin

Gentlemen:

Subject: John Day Acclimation
Hat Rock Park

Enclosed is a letter from the Oregon Parks and Recreation Division. It responds to my request for apporval to use areas within Hat Rock State Park for our proposed acclimation facilities.

As you will note they have denied use of the west land based site and the trailer/food freezer site that went with the net pen concept. (They did not address net pens in the water because, I believe, they do not have the necessary jurisdiction. We will pursue this.)

It appears, from their letter, that the east site is still viable. After we have further refined concepts for this location we will furnish the additional information they requested.

Also enclosed are copies of the site plan sketches which show the concepts being considered. You already have these but new ones will save you a trip to your file.

Please let me know if you have comments or questions.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

cc: Harold Hanson
Oregon Dept. of Fish & Wildlife

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

June 1, 1987

Oregon Department of Transportation
Parks and Recreation Division
525 Trade Street S.E.
Salem, Oregon 97310

Attention: Mr. David W. Wright
Park Land Supervisor

Gentlemen:

Subject: Hat Rock State Park

Thank you for your prompt response to my May 1, 1987 letter regarding salmon fry rearing at Hat Rock State Park.

We understand why you feel the west land based and net pen trailer sites are unacceptable. This use would interfere with recreational activities and we do not dispute your decision. However, since Hat Rock Pond has such good potential for raising chinook salmon, we would like you to consider a significantly revised proposal.

The enclosed drawings show two alternate concepts for fry rearing in Hat Rock Pond and a concept for adult capture that could be used with either. These are planned to minimize impacts on recreational use during the peak season.

One idea calls for floating net pens in the area between the river and dike. This was presented before but it had associated shore based facilities and I did not mention that the pens could be removed when not in use. Please recall that they are only needed during May each year. The pens are held in place with a system of anchors, lines and floats; some of which could remain during other months for boat moorage, if desired.

The other idea is to subdivide the pond upstream of the dike with three nets stretched form shore to shore. This would require inconspicuous, permanent anchors on each side. A cable supporting a fine mesh net would be between them. A heavy lead line would hold the net on the bottom. Jim phelps, N.E. District Biologist for ODF&W and I have discussed how this proposal might impact the existing rainbow trout program. Mr. Phelps said that the trout are fished heavily during March and April and that by May 1 they are mostly gone. He felt that there would be no significant conflict and that there would be a positive benefit from returning chinook salmon adults.

The adult capture proposal has a small fish ladder through the dike. It would lead adults to pens built on a compacted gravel fill. There would be two holding areas and a sorting area. The pens would consist of a pipe picket fence that could be removed when not in use. There would be a new culvert with a slide gate to allow the pond level to be lowered. The existing culverts would have slide gates installed and they would be improved to prevent fish passage either way while the pond operates as it does now. The adult capture facility would be needed for approximately six to eight weeks during October and November each year.

From June through March, when there is no fry rearing, you will not be able to see any evidence of net pens or net enclosures. From December through September the only evidence of an adult capture would be the fish ladder and valve stems and hand wheeks to operate the slide gates. The dike would still be open for pedestrians and the fish ladder would be covered for safety.

While fry are on-site, feeding would occur several times per day. Fish in the net pens would be fed from a boat. Those in the pond would be fed with a gasoline powered food blower operating from shore. The fish food freezer and the employee residence would, for instance, be in the nearby mobile home park.

Please review these ideas and at your convenience let me know if you feel they are acceptable. Even though at times this program could conflict with park use, perhaps the benefit from returning salmon would compensate.

Thank you for your continuing assistance.

Very truly yours,

SVERDRUP CORPORATION

HT Andersen

Harold T. Andersen

Enclosure

cc: Harold Hanson, ODF&W w/enclosure
Jim Phelps, ODF&W w/enclosure
Bill Stripland USF&W

NEIL GOLDSCHMIDT
GOVERNOR

*Department of Transportation*
PARKS AND RECREATION DIVISION
525 TRADE STREET SE, SALEM, OREGON 97310

July 6, 1987

RECEIVED
JUL - 9 1987
SVERDRUP CORP.
SEATTLE OFFICE

Harold Andersen
Sverdrup Corporation
PO Box 369
Bellevue, WA 98009

Dear Mr. Andersen:

The Parks Division has reviewed your revised proposal for salmon rearing at Hat Rock State Park. We still have problems with several aspects of the proposal. The dike is in poor condition already and adding anchors, line, floats, etc. would not improve the appearance of the area.

Another question is in regard to pond lowering. Your proposal is not very specific about your needs. We are concerned about how this would affect the water supply for other uses in the area.

In order to properly evaluate your proposal, we would need more specific information. There is some possibility that we could work with you in the future on this project. Perhaps some form of recreation enhancement could be included in the proposal.

Sincerely,

David W. Wright
David W. Wright
Park Land Supervisor

DWW:jn
4108D

cc : Larry Jacobson
Owen Lucas
Joe Paiva

Sverdrup
CORPORATION

1200 112th Avenue, N.E
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

September 4, 1987

Pacific Northwest Bell
421 S.W. Oak, Room 3Nl
Portland, Oregon 97204

Gentlemen:

Subject: Hat Rock Park Acclimation Facility

This is to inquire about the availability and cost for telephone service to a proposed fisheries facility near Hat Rock State Park, Oregon. Location and vicinity maps and a site plan are enclosed.

The area proposed for this facility is undeveloped and new lines will be required. I suspect they would be buried parallel to the access road shown. However, an extension from McNary Marina may be more economical. In preparing your cost estimate, please assume that all necessary permits and right-of-way will be provided.

Sverdrup is performing a chinook salmon fry rearing feasibility study for the U.S. Fish and Wildlife Service and this site is one of several being considered. There will be housing for the facility manager and the need is for a residential hook-up only. Fry rearing will occur during May and adult capture and spawning will last six to eight weeks in October and November. These are the only times the site will be used.

At your convenience, please send me a letter that gives an approximate cost for providing this telephone service.

Please let me know if you have questions. Thank you for your assistance.

Very truly yours,

SVERDRUP CORPORATION

Harold T. Andersen

Harold T. Andersen, P.E.

Enclosure

Carla (503) 241-0811 9/14/87
cost = 0.83/ft for line extension
plus $80 hookup
6000' x .83 + 80 = 5060
use $5100

Pacific Northwest Bell
A US WEST COMPANY

Hat Rock

September 15, 1987

Mr. Harold Andersen
c/o Sverdrup Corporation
P. O. Box 369
Bellevue, WA 98009

Dear Mr. Andersen:

I am writing in regard to our telephone conversation on September 14, 1987.

As agreed, I am sending you information pertaining to construction costs for the proposed fisheries facility near Hat Rock State Park in Oregon.

Our engineer, John Standley, advised me the construction cost would be 83 per foot for the approximately 6,000 feet of line extension.

Our construction crew will bury cable parallel to the access road shown on your "Vicinity Map", as the ground allows.

This information is a "guesstimate" as our engineer did not make an on site visit. Once an order has been placed for telephone service, actual figures can be quoted. The job would then be engineered by our engineering group.

In addition, our rates are subject to change.

If you have any further questions regarding this matter, please feel free to call me at 345-6784. My hours are 8:00 a.m. to 4:30 p.m., Monday through Friday.

Very truly yours,

Karla Barle't

Karla Barle't
Service Representative
Federal Government Accounts

SEP 18 1987

**Sverdrup**
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

file copy

May 22, 1987

Umatilla Electric Cooperative
P.O. Box 1148
Hermiston, Oregon 97838

Attention: Mr. Bill Kopacz

Gentlemen:

Subject: Power Service
Hat Rock Acclimation Facility

This is to inquire about the availability and cost for power service to a site east of the Hat Rock State Park. The location and site plan are shown on the enclosed drawings.

Sverdrup is performing a chinook salmon fry rearing feasibility study for the U.S. Fish & Wildlife Service and this site is one of several being considered. The power requirement is approximately 90 horsepower for pumping, 3 horsepower for a fish food freezer and probably a 200 amp service for a residence and low level outdoor lighting. This facility would only operate during May and for six to eight weeks in October and November.

At your earliest convenience, please send me a letter that gives an approximate cost for providing this electric service. Also, please include your power rates so that we can estimate operational costs.

Please let me know if you have questions. Thank you for your assistance.

Very truly yours,

SVERDRUP CORPORATION

Harold T. Andersen, P.E.

Enclosure

UMATILLA ELECTRIC COOPERATIVE ASSOCIATION
750 W. ELM • P.O. BOX 1148 • HERMISTON, OREGON 97838
Telephone (503) 567-6414

June 4, 1987

RECEIVED
JUN - 8 1987
SVERDRUP CORP.
SEATTLE OFFICE

Harold T. Andersen
Severdrup Corporation
1200 112th Avenue, N.E.
Suite Cl43
P 0 Box 369
Bellevue, WA 98009

RE: HAT ROCK ACCLIMATION FACILITY

Dear Mr. Andersen:

The cost to provide power to your location is based upon UECA's Board of Directors' policy which states, 'It is the policy of the Umatilla Electric Cooperative Association to provide electrical service to all consumers upon payment of a line extension fee calculated as the difference between the historical average system cost and the present average system extension cost or the proportionate percentage of the total extension cost, whichever is greater. The cost will be calculated on a footage basis and updated in April of each year."

In your particular case the $1.39 per foot prevails. Also, enclosed, for your review, is a map of the proposed route to the site, the line extension contract, and statement for $9,035 for the line. Our engineers designed the service as underground all the way from the highway. The thought was to locate the cable in the middle of the road. Below I have shown the cost and calculations for the minimum per year:

| | |
|---|---|
| Total Cost | $42,716 |
| Less aid in contribution | 9,035 |
| Difference | $33,681 |
| 10% | x .l0 |
| Minimum per year | $ 3,368 |

Thus, refer to the line extension contract for the terms and the conditions of the contract. The agency that will end up with the service will have to take out a membership and pay the appropriate deposit of $125.00.

If you have any questions, please call.

Sincerely, ,

Bill Kopacz

Bill Kopacz
Customer Service Manager

BK/lh
Encl.

AGREEMENT FOR ELECTRIC SERVICE

2 services

Date meter set____________

Meter #____________

Grid # 5N29E231800

AGREEMENT made ____________, 19 87, between Umatilla Electric Cooperative Association (hereinafter called the "Seller"), and ____________

____________ (hereinafter called the "Consumer"),

a Corporation .
(corporation, partnership, or individual)

The Seller shall sell and deliver to the Consumer, and the Consumer shall purchase all of the electric power and energy which the Consumer may need at

The NE¼ of the NW¼ of Section 14, Township 5 North, Range 29 EWM.

____________ up to 25 / 112 1/2 kilowatts, upon the following terms:

1. SERVICE CHARACTERISTICS

a. Service hereunder shall be alternating current, 1 / 3 phase, 3 / 4 wire, sixty cycles, 120/240 / 277/480 volts.

b. The Consumer shall not use the electric power and energy furnished hereunder as an auxiliary or supplement to any other source of power and shall not sell electric power and energy purchased hereunder.

2. PAYMENT

a. The Consumer shall pay the Seller for service hereunder at the rates and upon the terms and conditions set forth in Schedule 3 attached to and made a part of this Agreement. Notwithstanding any provision of the Schedule and irrespective of Consumer's requirements for use of electric power and energy, the Consumer shall pay to the Seller not less than $3,368.00 per ~~month and/or~~ year for service or for having service available hereunder during the terms hereof.

b. The initial billing period shall start when Consumer begins using electric power and energy, or fifteen (15) days after the Seller notifies the Consumer in writing that service is available hereunder, whichever shall occur first.

c. Bills for service hereunder shall be paid at the office of the Seller in Hermiston, State of Oregon. Such payment shall be due within fifteen (15) days after the bill is mailed to the Consumer. If the Consumer shall fail to make any such payment within fifteen (15) days after such payment is due, the Seller may discontinue service to the Consumer upon giving fifteen (15) days' written notice to the Consumer of its intention so to do, provided, however, that such discontinuance of service shall not relieve the Consumer of any of its obligations under this Agreement.

d. The Consumer agrees that the Seller may make modifications, that are cost justified and supportable by a cost of service study, of the rate for service hereunder as a condition of this Agreement.

3. MEMBERSHIP

The Consumer shall become a member of the Seller, shall pay the membership fee and be bound by such rules and regulations as may from time to time be adopted by the Seller.

4. CONTRIBUTION

The Consumer shall pay to the Seller the sum of $ 9,035.00 as a contribution in aid of construction on account of the cost of facilities required to make service available to the Consumer before commencement of construction of such facilities. No refund shall be made to the Consumer of any portion of the contribution in aid of construction.

5. CONTINUITY OF SERVICE

The Consumer shall use reasonable diligence to provide a constant and uninterrupted supply of electric power and energy hereunder. If the supply of electric power and energy shall fail or be interrupted, or become defective through act of God, governmental authority, action of the elements, public enemy, accident, strikes, labor trouble, required maintenance work, inability to secure right-of-way, or any other cause beyond the reasonable control of Seller, the Seller shall not be liable therefor or for damages caused thereby.

6. RIGHT OF ACCESS

Duly authorized representatives of the Seller shall be permitted to enter the Consumer's premises at all reasonable times in order to carry out the provisions hereof.

7. TERM

This Agreement shall become effective on the date first above written and shall remain in effect for a period of 5 years following the start of the initial billing period, and thereafter until terminated by either party giving to the other six (6) months' notice in writing.

8. SUCCESSION AND APPROVAL

a. This Agreement shall be binding upon and inure to the benefit of the successors, legal representatives and assigns of the respective parties hereto.

b. This contract shall not be effective unless approved in writing by the Administrator of the Rural Electrification Administration and the National Rural Utilities Cooperative Finance Corporation.

9. DEPOSIT

The Consumer shall deposit with the Seller the sum of $_________ on account of the cost of facilities required to make service available to the Consumer on or before commencement of construction of such facilities. Such deposit shall be returnable to the Consumer in the form of a credit on each bill for service in the amount of ____ percent of the bills, which credits shall continue until they total $_______________. No refunds shall be made to the Consumer of any portion of the deposit remaining upon termination of the Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement all as of the day and year first above written.

| | |
|---|---|
| | UMATILLA ELECTRIC COOPERATIVE ASSOCIATION |
| ______________________________ Consumer | By ______________________________ President |
| By ______________________________ Title | |
| ATTEST: | ATTEST: |
| By ______________________________ | By ______________________________ Secretary |

UMATILLA ELECTRIC COOPERATIVE ASSOCIATION

P. O. BOX 1148 Telephone 567-6414
HERMISTON, OREGON 97838 LONG DISTANCE 1-800-452-2273

SCHEDULE 3

COMMERCIAL AND INDUSTRIAL RATE

EFFECTIVE WITH BILLINGS CALCULATED AFTER NOVEMBER 1, 1985

AVAILABILITY: Service under this classification shall be available throughout the service area of the Cooperative for all commercial, industrial and non-residential electric service for light, heat, and power. Appropriate written contracts shall be required of industrial consumers where the load exceeds 750 KW of measured demand.

TYPE OF SERVICE: 60 cycle, alternating current at such phase and voltage as the Cooperative may have available.

MONTHLY CUSTOMER CHARGE:

Single phase: $ 9.00 per month for each meter
Multi-phase: $13.00 per month for each meter

ENERGY CHARGES:

First 5,000 KWH per month @ 4.50c per KWH
Next 60,000 KWH per month @ 3.20¢ per KWH
Over 65,000 KWH per month @ 2.35¢ per KWH

DEMAND CHARGE:

First 20 KW of billing demand per month - no charge
Over 20 KW For bills calculated May thru November $3.60 per KW
Over 20 KW For bills calculated December thru April $5.33 per KW

DEMAND CHARGE FOR SERVICES WITH TIME-OF-DAY METERS:

For bills calculated in May through November = $1.00 per KW of billing demand per month, plus $2.60 per KW of billing demand per month created Monday through Saturday from 7:00 A.M. to 10:00 P.M.

For bills calculated in December through April - $1.00 per KW of billing demand per month,plus $4.33 per KW of billing demand per month created Monday through Saturday from 7:00 A.M. to 10:00 P.M.

A special time-of-day meter is required to determine off-peak usage and special arrangements with the UECA are required for those users who confine their billing demand to Monday through Saturday from 10:00 P.M. to 7:00 A.M.and all day Sunday. An additional charge may be made for the installation of time-of-day metering equipment.

POWER FACTOR: The consumer agrees to maintain unity power factor as nearly as practicable. The association reserves the right to measure such power factor at any time. Should such measurements indicate that the average power factor is less than 95%, the demand for billing purposes shall be increased 1% for each 1% or major fraction thereof by which the average power factor is less than 95% lagging.

ROUNDING: All Billings and Discounts will be rounded to the nearest whole Dollar.

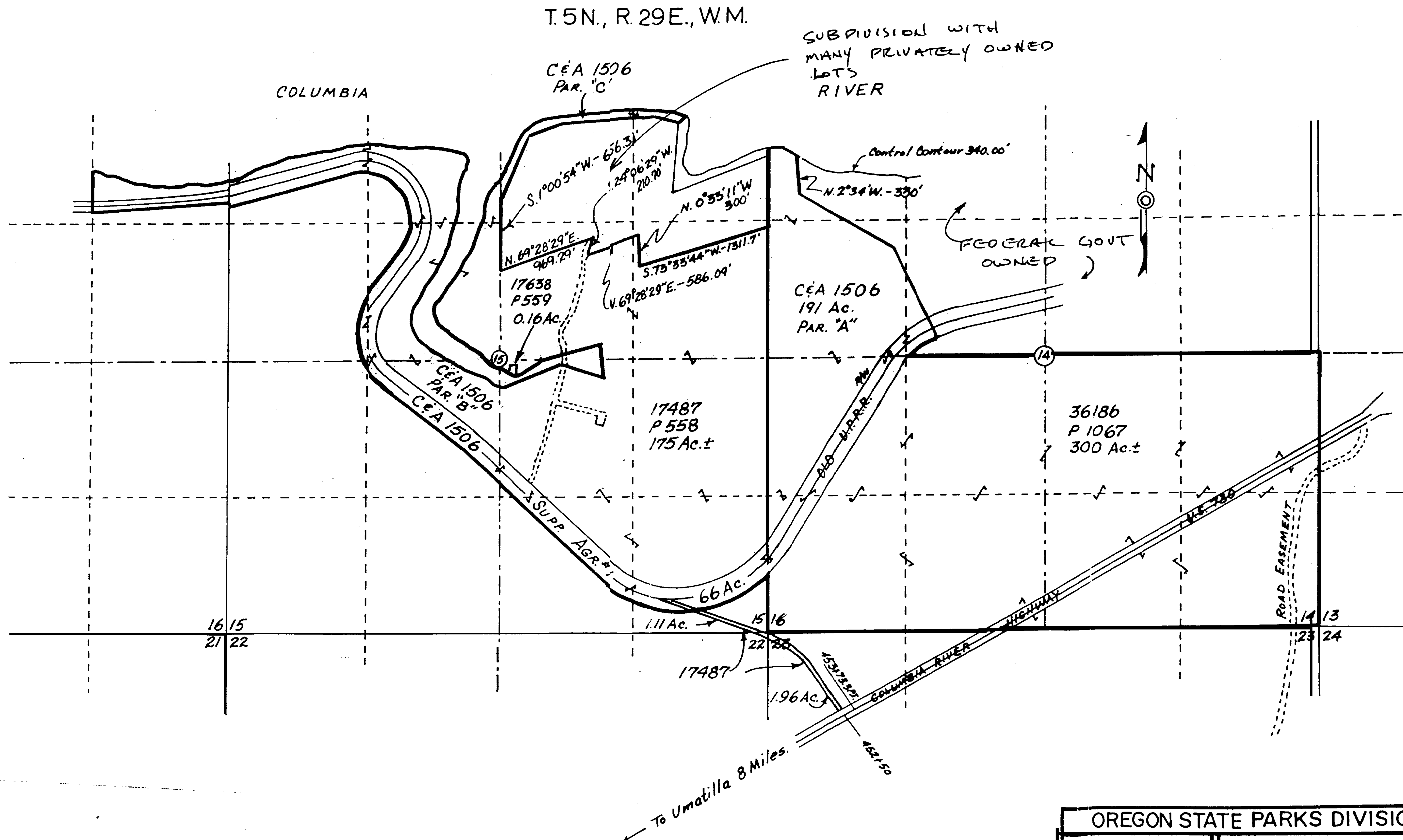
TERMS OF PAYMENT: All billings are issued monthly. All bills are due and payable within twenty (20) days of being issued, After that date they are considered past due. If payment of the bill is received by Umatilla Electric in full, including service charges and deposits, on or before the past due date,then a discount of 3% of the current billing, Not including service charges and deposits, will be credited to the next months bill.

FRANCHISE FEES OR TAX ADJUSTMENTS: The amounts of any franchise fees or franchise taxes levied by any quasi-municipal entity shall be added to the above charges for electricity sold within the area where such fee or tax is imposed, excepting franchise fees paid to cities.

GENERAL TERMS AND CONDITIONS: Service under this classification is subject to the General Rules and Regulations of the Cooperative.

# APPENDIX B

## LAND OWNERSHIP INFORMATION




DAVID W. WRIGHT
Park Land Supervisor
STATE PARKS & RECREATION DIVISION

Department of Transportation
525 Trade St. SE, Suite 301 Salem 97310 Phone 378-5010

| OREGON STATE PARKS DIVISION | |
|---|---|
| | BOUNDARY |
| For | HAT ROCK STATE PARK |
| Highway | COLUMBIA RIVER |
| County | UMATILLA |
| Scale 1" = 1000' | Date 9-26-66 |

REV. 1-13-69
REV. 11-29-83.

# APPENDIX C

# GROUND WATER HYDROLOGY

REPORT OF GROUND WATER RESOURCE EVALUATION

WILLOW CREEK AND HAT ROCK ACCLIMATION FACILITIES

GILLLAM AND UMATILLA COUNTIES, OREGON

FOR THE

U.S. FISH AND WILDLIFE SERVICE



GeoEngineers Incorporated

# GeoEngineers Incorporated

(206) 746 5200
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2405 140th Ave N.E.
Bellevue WA 98005

Consulting Geotechnical
Engineers and Geologists

May 18, 1987

Sverdrup Corporation
1200 - 112th Avenue Northeast
Bellevue, Washington 98009

At tention: Mr. Harold T. Andersen

Gentiener.:

We are submitting four copies of our report describing the results of our evaluation of the ground water resources at the proposed Willow Creek and Hat Rock acclimation facilities. The scope of our services is given in our technical services agreement with Sverdrup Corporation dated May 7 1987.

We appreciate the opportunity to be of service and look forward to working with Sverdrup and the U.S. Fish and Wildlife Service in exploring and developing a ground water resource at the proposed acclimation facilities. Please call if you have any questions regarding our report.

Yours very truly,

GeoEngineers) Inc.

James A. Miller

James A. Miller
Principal

JHB:JAM:da

File No. 0758-10-4

# TABLE OF CONTENTS



**List of Figures**

REPORT OF GROUND WATER RESOURCE EVALUATION
WILLOW CREEK AND MT ROCK ACCLIMATION FACILITIES
GILLIAH AND UMATILLA COUNTIES, OREGON
FOR THE
U.S. FISH AND WILDLIFE SERVICE

## INTRODUCTION

The results of our evaluation of the potential for developing 5 to 17.5 cfs ground water supplies at the proposed Willow Creek and Hat Rock acclimation facilities are presented in this report. The locations of the Willow Creek and Hat Rock sites are shown on Figures 1 and 2, respectively

Our evaluation of the potential for development of ground water supplies at the proposed facilities is based on a review of available water well reports and other geologic data.

## REGIONAL HYDROGEOLOGY

### GENERAL

The principal ground water aquifers in the region exist within the basalt flows of the Columbia Basalt Group (CRBG). The basaltic lava flows that comprise the CRBG accumulated during a series of very large scale eruptions which occurred 10 to 17 million years ago. These basalt flows exist over a widespread area of eastern Oregon and Washington. Less extensive ground water aquifers exist on a localized basis within sediments that overlie the basalt flows.

Bedrock consisting of a thick sequence of layered basalt flows and associated sedimentary interbeds underlies both the Willow Creek and Hat Rock sites. The total thickness of the layered basalt flows may exceed 5000 feet with individual flows averaging about 100 feet thick. The individual basalt flows are often separated from each other by sedimentary interbeds (silt, sand or gravel) of varying thickness.

The stratigraphic relationship and nomenclature of the CRBG basalt flows and sedimentary interbeds which exist in the region are shown on Figure 3.

The central portion of the individual basalt flows is often very dense and is generally unproductive with respect to ground water supply. The upper portion of most basalt flows is vesicular with a honeycomb-like


GeoEngineers Incorporated

texture. This zone formed as gas bubbles rose toward the surface of the flow when the lava cooled. The upper vesicular zones of the lava flows are generally highly permeable and often form moderate to high-yield aquifers in tie region.

Although the individual basalt flows exist over a relatively large area, the permeability of the upper vesicular zones normally varies from one location to another. The variation in permeability is often caused by the thinning of the vesicular zone and/or by secondary filling of the porous zone with clay or other minerals. The difference in permeability from one location to another results in a variable yield to water wells completed within the same vesicular zone.

The sedimentary interbeds which exist between the basalt flows in the Willow Creek/Hat Rock region are generally fine-grained and are not significant sources of ground water.

WILLOW CREEK REGION

The locations of the Willow Creek site and an alternative site at Threemile Canyon are shown on Figure 1. Nearly all of the water wells in the Willow Creek region obtain their supply from basalt aquifers. Data from water wells located in the Willow Creek region are summarized in Table 1. The following descript ton of the Willow Creek site also applies to the Threemile Canyon site.

Extensive development of the ground water resource has occurred in the HOrse Heaven Hills area, about 8 to 12 miles north of the site. Relatively shallow (<500 feet deep) wells located north of the Columbia River are capable of producing low to moderate (15 to 400 gpm) yields of water. Most water wells located in the Horse Heaven Hills are relatively deep (500 to over 1400 feet deep) and are capable of producing moderate to very high (750 to 7500 gpm) yields. Interpretation of geophysical logs suggest that the deep wells north of the site extend below the Mabton/Priest Rapids horizon. The deep wells encounter semi-confined aquifers which are often artesian. Artesian flows of over 2000 gpm have been reported for Wells 5N,/23E-29Pl and 30. The Mabton sedimentary interbed and Priest Rapids basalt flow appear to act as a confining layer (aquitard) to regional ground water flow in the Horse Heaven Hills. Basalt aquifers above the Mabton/Priest Rapids horizon appear to be capable of supplying only low to moderate yields to water wells.

Water wells located south of the river in the Willow Creek region are generally shallower and less productive than wells located north of the river. Relatively shallow (C500 feet deep) wells located south of the river are capable of producing low to moderate (30 to 300 gpm) yields. Relatively deep (500 to 875 feet deep) wells south of the river are capable of producing moderate to high (100 to 1000 gpm) yields.

The deep basalt aquifers located south of the river are semi-confined but artesian flows have not been encountered. Geophysical logs of these wells are not available and it is uncertain whether the wells penetrate the Mabton/Priest Rapids horizon. Hence, it is also uncertain whether the Mabton/Priest Rapids horizon serves as an aquitard to regional ground water flow in the area south of the river.

It appears that the Elephant Mountain and/or Pomona basalt flows are exposed at the ground surface in the Willow Creek region. We estimate that. the Mabton/Priest Rapids horizon would be encountered at a depth of 700 to 900 feet at the Willow Creek site.

## HAT ROCK REGION

The location of the Hat Rock site is shown on Figure 2. Water wells located in the Hat Rock region obtain their supply from alluvial gravel above the basalt bedrock and from deeper basalt aquifers. Data from water wells in the Hat Rock region are summarized in Table 2.

Water wells located within a mile of the site (within Section 15) are relatively shallow (74 to 120 feet deep) and capable of producing low to moderate (30 to 500 gpm) yields. These wells obtain their supply from a gravel aquifer which appears to extend southwesterly from the site for a distance of about 3 miles (with Sections 16, 17, 20 and 21). Yields of up to 1500 gpm have been reported from shallow wells in Section 20.

Hat Rock and Ship Rock (located just east of Hat Rock) are isolated outcrops of basalt which project above the surrounding ground surface. Hat Rock and Ship Rock are the remnants of a basalt flow, probably the Pomona or

Umatilla flows, which was eroded by glacial floods about 11,000 years ago. The gravel aquifer near the site was probably deposited during these glacial floods.

The presence of basalt at the surface in close proximity suggests that the gravel aquifer is not extensive and may be absent at the site. The gravel aquifer is also relatively thin and does not appear to have a large horizontal extent. The relatively high yields reported on the water well records are from short-term pumping tests; and in our opinion, it is unlikely that the gravel aquifer could sustain the high yields over a long-term pumping program.

Wells located north and south of the Hat Rock and outside of the relatively small area in which the gravel aquifer exists, obtain their supply from basalt aquifers. Water wells located north of the river range in depth from about 300 to 1100 feet and are capable of supplying only relatively low yields ranging from 5 to 100 gpm. Relativey shallow ((:350 feet) wells located south of the river are capable of producing low (20 to 75 gpm) yields. Relatively deep (380 to 600 feet deep) wells located south of the river are capable of producing low to high (40 to 1000 gpm) yi elds.

## GROUND WATER QUALITY

### GENERAI,

The quality of ground water from the basalt aquifers beneath the Columbia Plateau is generally excellent. The concentration of dissolved oxygen is often low and may require aeration for use in acclimation facilities.

### GROUND WATER TEMPERATURE

Plots of ground water temperature versus the depth of the well for the Willow Creek and Hat Rock regions are shown on Figures 4 and 5, respectively. A relatively poor correlation exists between temperature and depth. This poor correlation is caused by several factors including the method of data collection. Most of the available temperature data were measured during pumping tests and recorded on water well reports. Water often enters the well at one or more depths that are shallower than the base of the well. The temperature measured during the pumping tests normally reflects the temperature of ground water from depths shallower than the base of the well.

Several of the deep well temperature data are bottom-hole temperatures which were measured during geophysical logging of wells located north of the river.

The available data indicate that ground water temperatures generally increase with increasing depth in the region. We understand that a water temperature above 20°C is detrimental to fish which will use the acclimation facilities.

The available temperature versus depth data indicate that ground water temperatures above 20°C may be encountered below 600 to 700 feet in the Willow Creek and Hat Rock regions. Ground water temperatures between 24 to 28°C may be encountered at a depth of 1000 feet.

## DISCUSSION AND RECOMMENDATIONS

### GENERAL

The potential for developing a 5 to 17,5 cfs ground water supply through completion of multiple water wells appears to exist at the Willow Creek site. The development of a 5 cfs supply at the Hat Rock site may not be feasible based on the relative absence of wells that obtain their water supply from high-yield basalt aquifers.

Ground water supplies obtained from below a depth of 600 to 700 feet may 'nave to be mixed with shallower ground water and/or with surface water because of the higher than optimum temperatures expected in the deeper basalt aquifers.

### WILLOW CREEK SITE

Water wells have not been completed in close proximity to the Willow Creek site based on review of available information. Deep moderate to very high yield, water wells have been completed within the basalt aquifers at locations which are several miles from the Willow Creek site.

On a preliminary basis, we estimate that a minimum of one to five wells will be needed to provide a 5 cfs supply at the Willow Creek site assuming that the well depths will range from 500 to 1000 feet and that moderate to very high yield aquifers are encountered. We estimate that a minimum of three to twenty wells would be required to provide a 17.5 cfs supply at the Willow Creek site based on the above assumptions.

We estimate that the wells should be located on 1000-foot centers to avoid excessive interference between the wells. Costs associated with piping and power requirements may be relatively high if only moderate yield aquifers are encountered. We expect that surface water would be needed to supplement the ground water supply to provide a 17.5 cfs flow if only moderate yeild aquifers are encountered.

We recommend that a lOOO-foot-deep test well be completed if siting of the acclimation facilities is anticipated at the Willow Creek or Threemile Canyon site.

The purpose of the test well includes:

1. Exploring shallow and deep basalt aquifer conditions.
2. Measuring water quality parameters in the aquifers that are encountered.
3. Providing information for the design of production wells.
4. Providing estimates of production well yield and pump requirements.

HAT ROCK SITE

Many shallow, moderate to high yield water wells have been completed in the gravel aquifer at locations within relatively close proximity of the Hat Rock site. As described earlier, the gravel aquifer, if present, does not appear to have the potential for providing a long-term 5 cfs supply at the site.

Deep water wells that are completed in the basalt aquifers and located several miles north of the site are capable of providing only low yields. Water wells that are completed in the basalt aquifer and located south of the river are generally capable of producing low yields with only occasional moderate to high yields reported. Data related to potential well yields for wells greater than 600 feet deep are not available for the region south of the river.

The potential for developing moderate to high yields from wells less than 600 feet deep appears low. The feasibility of developing moderate to high yields from wells deeper than 600 feet is relatively unknown but does not appear favorable at the Hat Rock site.

We recommend that a lOOO-foot-deep test well be completed if siting of the acclimation facilities is anticipated at the Hat Rock site. The test well is intended to provide the following:

1. Explore for the presence and extent of the shallow gravel aquifer at the site.
2. Explore shallow and deep basalt aquifer conditions.
3. Measure water quality parameters in the aquifers encountered.
4. Provide information for the design of production wells.
5. Providing estimates of production well yield and pump requirements.

## TEST WELL

### GENERAL

We recommend that the test well be a minimum of 6 inches in diameter and extend to a depth of about 1000 feet. It is normally necessary to drill the shallower sections of the test well at a larger diameter in order to achieve the minimum 6-inch diameter in the deeper sections of the test well. Most deep wells in the basalts are drilled with three reductions in casing diameter. We recommend that the test well begin as a 10- to 12-inch-diameter bore.

### TEST PROGRAM

We further recommend that long-term pumping tests be conducted during and after completion of the test well. Pumping tests of over 72 hours may be necessary if very high yield aquifers are encountered.

Water quality parameters, including temperature, conductivity and pH, should be measured during the drilling and pumping tests. Water samples should be collected and analyzed for concentrations of dissolved metals and oxygen.

## COST EST IMATE

The following cost estimate should be considered as approximate because of the relatively uncertain nature of the hydrogeological conditions that will be encountered during test well construction. Costs may also vary with the time of well construction due to variable demand for drilling services and fluctuations in costs for well materials.

We estimate that construction and pump testing of a lOOO-foot-deep test well will cost about $35,000 to $45,000. We further estimate that costs for monitoring well construction and pump testing activities, analyzing pumping test data, and providing design parameters for production wells will range between $10,000 to $15,000. We expect that the total cost for the test well will rangebetween $45,000 and $60,000. These estimated costs do not include provisions for difficult access conditions.

Sustained high to very high yields from the test well may not be possible because of the relatively small diameter of the test well. It may prove more economical to construct a 12-inch-diameter “test” production well, especially at the Willow Creek site. The larger-diameter well could be utilized at the proposed facilities at a higher pumping rate if high to very high yield aquifers are encountered. We estimate that installation of the 12-inch-diameter well would increase well construction costs by about $35,000 to $40,000.

## SUMMARY

The potential for developing a 5 to 17.5 cfs ground water supply appears to greater atthe Willow Creek site as compared to the Hat Rock site. Site-specific data are not available at either sites. We recommend that a test well be completed prior to finalizing plans for the acclimation facilities.

USE OF THIS REPORT

We have prepared this report for use by Sverdrup Corporation and by the U.S. Fish and Wildlife Service. Our recommendations are based on a review of available hydrogeologic data and considerable judgment. Although the ground water supply potential appears promising at the Willow Creek site and less favorable at the Hat Rock site, our interpretations and recommendations should not be construed as a warranty of subsurface conditions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No other conditions, express or implied, should be understood.

0 0 0 -

We appreciate the opportunity to be of service. Please call if you have any questions regarding our report.

Respectfully submitted,

GeoEngineers, Inc.

John H. Biggane
Geological Engineer

James A. Miller
Principal

JHB: JAM:wd

TABLE 1 SUMMARY OF WATER WELL DATA - WILLOW CREEK REGION

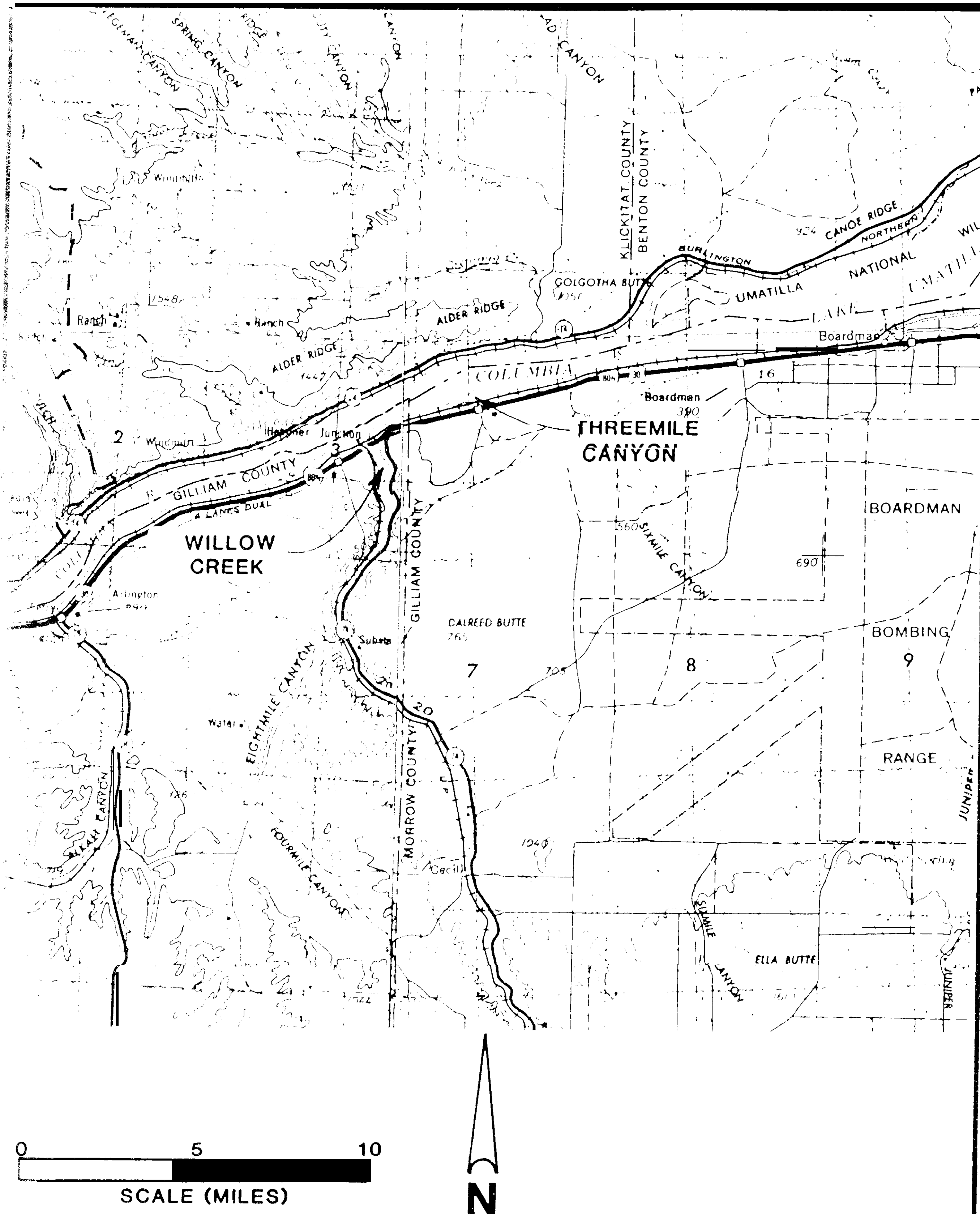
| WELL NUMBER (TN-RG-SEC) | DEPTH (FEET) | DEPTH TO STATIC WATER LEVEL (FEET) | YIELD (GPM) | SPECIFIC CAPACITY (GPM/FT. /FT. OF DRAWDOWN) | AQUIFER | TEMPERATURE (CELCIUS) | COMMENT |
|---|---|---|---|---|---|---|---|
| 3N/22E-2 | 465 | 341 | 75 | 0.8 | BASALT INTERBED | | |
| 3N/22E-14F1 | 527 | 65 | 100+ | - | BASALT | 17.8 | DRAWDOWN NOT REPORTED |
| 3N/22E-14B1 | 325 | 104 | 200 | - | BASALT | | DRAWDOWN NOT REPORTED |
| 3N/22E-23 | 343 | 100 | 30 | 0.3 | BASALT | | |
| 3N/22E-23 | 93 | 29 | 50 | 0.8 | BASALT | | |
| 3N/22E-23C1 | 275 | 175 | 75 | 1.5 | BASALT | | |
| 3N/22E-23E1 | 340 | 125 | - | | BASALT | | |
| 3N/22E-23F1 | 263 | 120 | 40 | | BASALT | | DRAWDOWN NOT REPORTED |
| 3N/22E-26 | 153 | 30 | 5 | 0.1 | CLAY | | |
| 35K1 | 406 | 225 | 160 | 1.0 | BASALT | | |
| 3N/23E-3F1 | 740 | 193 | 346 | 9.9 | BASALT | 12.2 | |
| 3N/23E-3G1 | 843 | 245 | 376 | 6.8 | BASALT | 12.7 | DRILLER REPORTS 800 GPM MAX YIELD |
| 3N/23E-4B1 | 832 | 230 | 346 | 4.1 | BASALT | 12.7 | DRILLER REPORTS 800 GPM MAX YIELD |
| 3N/23E-9 | 200 | 150 | 200 | 0.8 | BASALT | | DRILLER REPORTS [illegible] GPM MAX YIELD |
| 3N/23E-9R1 | 700 | | | | BASALT | | |
| [illegible]-25 | 564 | 198 | 725 | 7.3 | BASALT | | |
| [illegible]-25F1 | 290 | 152 | 750 | 26.8 | BASALT | | |
| [illegible]3N1 | 45 | 21 | - | | GRAVEL | | |
| [illegible]7J1 | 38 | 26.7 | - | | | | |
| [illegible]-12 | 547 | - | - | - | - | | DRY WELL |
| [illegible]-34 | 157 | - | LOW | - | BASALT | | |
| [illegible]-35D1 | 305 | 0 | - | - | BASALT | | |
| [illegible]-4F | 260 | 150 | 45 | | BASALT | | DRAWDOWN NOT REPORTED |
| [illegible]27N1 | 875 | 281 | 1000+ | | BASALT | 14.4 | DRAWDOWN NOT REPORTED |
| [illegible]-35D1 | 100 | 25 | 300 | | BASALT | | |
| [illegible]24E-6J1 | 432 | 38 | - | - | GRAVEL/BASALT | | NO PUMP TEST DATA AVAILABLE |
| [illegible]-13D1 | 74 | FLOWING | 12 | - | BASALT | | ARTESIAN FLOW OF 12GPM |
| [illegible]-25F | 834 | +74 | 2500 | 68.2 | BASALT | | ARTESIAN WELL |
| [illegible] | 287 | 58 | - | | BASALT | | NO PUMP TEST DATA AVAILABLE |
| [illegible]-29A1 | [illegible] | 54 | 900 | 3.7 | BASALT | 21.1 | |
| [illegible]-29A2 | 860 | 72 | 1806 | 12.5 | BASALT | 22.2 | |
| [illegible]-29A3 | 1061 | 27 | 250 | 15.0 | BASALT | 28.1 | |
| [illegible]-29D1 | 812 | 115 | 2500 | 250.0 | BASALT | | |
| [illegible]3E-3R1 | 1100 | 256 | 750 | 750+ | BASALT | 17.7 | ZERO DRAWDOWN REPORTED @ 2500GPM |
| [illegible] | 150 | 125 | 95 | | BASALT | 16.0 | |
| [illegible] | 313 | 190 | 400 | 28.6 | BASALT | | |
| [illegible]-13 | 1446 | 128 | - | | BASALT | | NO PUMP TEST DATA AVAILABLE |
| [illegible]3E-13 | 776 | - | - | - | BASALT | | NO PUMP TEST DATA AVAILABLE |
| [illegible]N/23E-13R1 | 1081 | 144 | 2990 | 213.6 | BASALT | 28.8 | |
| [illegible]-27A1 | 1040 | 27 | | | BASALT | | |
| [illegible]-29D1 | 875 | + | 5170 | 15.9 | BASALT | 22.2 | ARTESIAN FLOW [illegible] |
| [illegible] | 843 | +12 | 4650 | 15.3 | BASALT | | ARTESIAN FLOW [illegible] |
| [illegible] | 250 | 220 | 15 | 2.5 | NO LOG | | |



GeoEngineers Incorporated

TABLE 2 SUMMARY OF WATER WELL DATA   HAT ROCK REGION

| WELL NUMBER ([illegible]) | DEPTH (FEET) | DEPTH TO STATIC WATER LEVEL (FEET) | YIELD (GPM) | SPECIFIC CAPACITY (GPM/FT. /FT. OF DRAWDOWN) | AQUIFER | TEMPERATURE (CELCIUS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| [illegible]E-15 | 92 | 46 | 300 | 7.9 | GRAVEL | | |
| [illegible]E-15 | 87 | 44 | 500 | 13.9 | GRAVEL | | |
| [illegible]E-15 | 96 | 62 | 500 | 17.9 | GRAVEL | | |
| [illegible]E-15 | 74 | 38 | 100 | 3.1 | GRAVEL | | |
| [illegible]E-15 | 95 | 36 | 30 | 2.0 | GRAVEL | | |
| [illegible]E-15N1 | 120 | 63.5 | 30+ | 30+ | GRAVEL | 12.2 | ZERO DRAWDOWN REPORTED AT 30GPM |
| [illegible]E-16G1 | 92 | 66 | 200 | 7.7 | GRAVEL | 14.4 | |
| [illegible] | 75 | 45 | 400 | 16.0 | GRAVEL | | |
| [illegible]E-20E1 | 203 | 53 | 100 | 0.8 | BASALT | | |
| [illegible]E-20G1 | 33 | 14 | 25 | 12.5 | GRAVEL/BASALT | | |
| [illegible]E-20R1 | 22 | 8 | 1500 | 75.0 | GRAVEL | | |
| [illegible]E-20R2 | 27 | 8 | 1000 | 37.0 | GRAVEL | | |
| [illegible]E-21 | 130 | 14 | 12 | 0.2 | BASALT | | |
| [illegible]E-21A1 | 95 | 53 | 700 | 18.9 | GRAVEL | | |
| [illegible]E-21E1 | 632 | 61 | 400 | 1.1 | BASALT | | |
| [illegible]E-21E2 | 21 | 8 | 30 | 6.0 | GRAVEL/BASALT | | |
| [illegible]E-22 | 100 | 20 | 40 | 2.0 | BASALT | | |
| [illegible]E-22 | 3 | 47 | 40 | 0.3 | BASALT | | |
| [illegible]E-22 | 265 | 153 | 35 | 0.4 | BASALT | | |
| [illegible]E-22 | 1[illegible]7 | 60 | 60 | 3.0 | BASALT | | |
| [illegible]E-22D1 | 390 | 54 | - | - | BASALT | | |
| [illegible]E-22P1 | 183 | 55 | 75 | -- | BASALT | 14.4 | DRAWDOWN NOT REPORTED |
| [illegible]E-23 | 224 | 66 | 20 | 0.2 | BASALT | | |
| [illegible]E-26 | 603 | 150 | 40 | 0.3 | BASALT | | |
| [illegible]E-26F1 | 925 | - | - | - | BASALT | | |
| [illegible]E-26M1 | 380 | 59 | 400 | 1.7 | BASALT | | |
| [illegible]E-26M2 | 525 | 15 | - | -- | BASALT | | |
| [illegible]E-26Q1 | 490 | 76 | 200 | -- | BASALT | 13.9 | DRAWDOWN NOT REPORTED |
| [illegible]E-27 | 110 | 21 | - | | BASALT | 16.7 | |
| [illegible] | 217 | 30 | - | - | BASALT | 15.5 | |
| [illegible] | 487 | 65 | 1000 | 2.6 | BASALT | | |
| [illegible] | 180 | 32 | - | - | BASALT | | |
| [illegible] | 200 | 10 | - | - | BASALT | | |
| [illegible] | 200 | 45 | - | - | BASALT | | |
| [illegible] | 160 | | - | - | BASALT | | |
| [illegible] | 428 | | - | -- | BASALT | | |
| [illegible]E-19A[illegible] | 685 | 345 | 42 | 0.2 | BASALT | | |
| [illegible]E-31 | 1008 | 300 | 200 | 1.0 | BASALT | | |
| | 1110 | 1070 | 5 | -- | BASALT | | |
| | 330 | 309 | 25 | - | BASALT | | |
| [illegible]E-12Q1 | 974 | 855 | - | - | BASALT | 21.0 | |
| [illegible] | 814 | 634 | 100 | 14.3 | BASALT | 23.3 | |
| [illegible] | [illegible] | 695 | 11 | - | BASALT | 12.7 | DRAWDOWN NOT REPORTED |

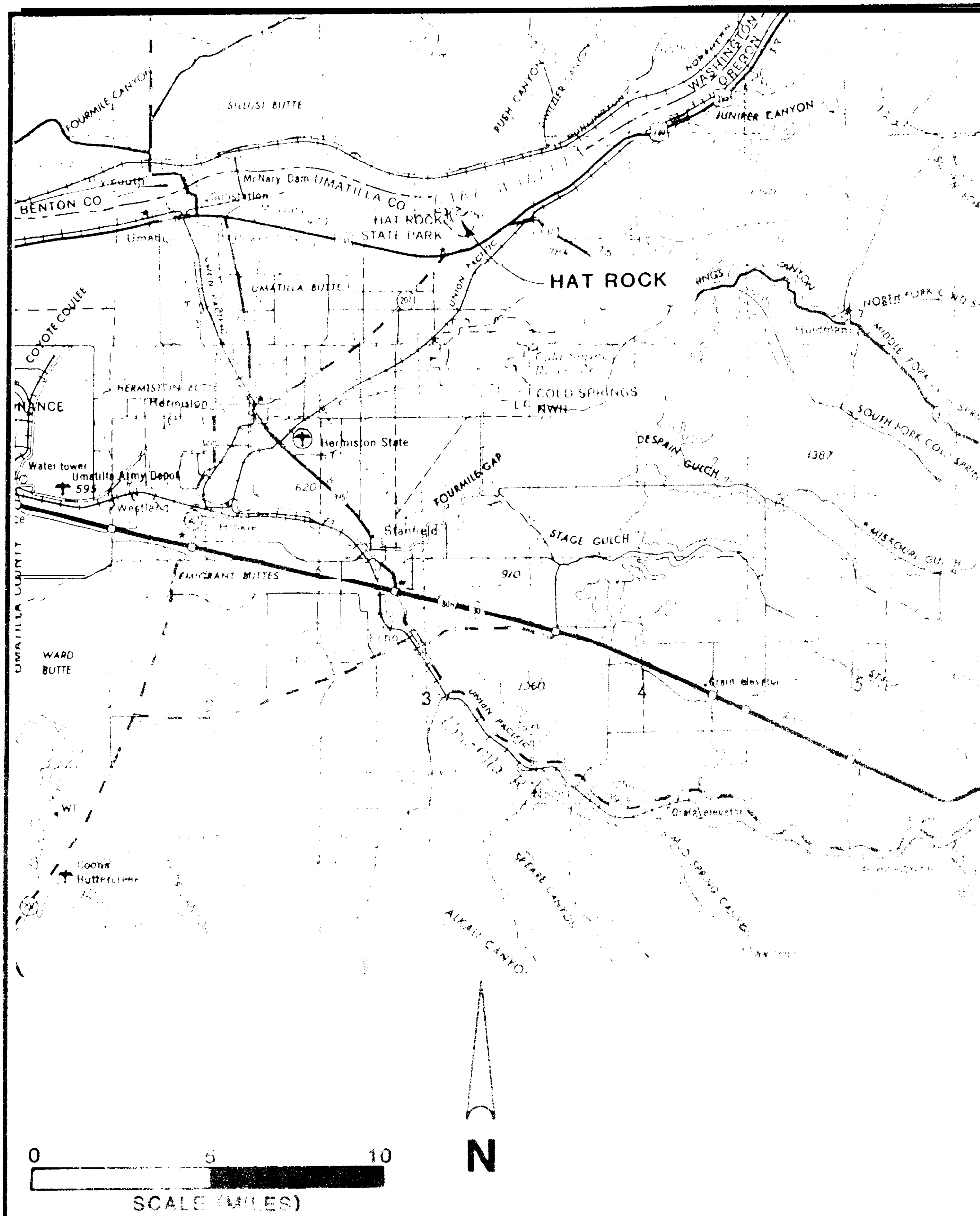



REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAPS, (SCALE 1:250,000), "THE DALLES, OR." AND "PENDLETON, OR."

GeoEngineers Incorporated

VICINITY MAP - WILLOW CREEK

FIGURE 1

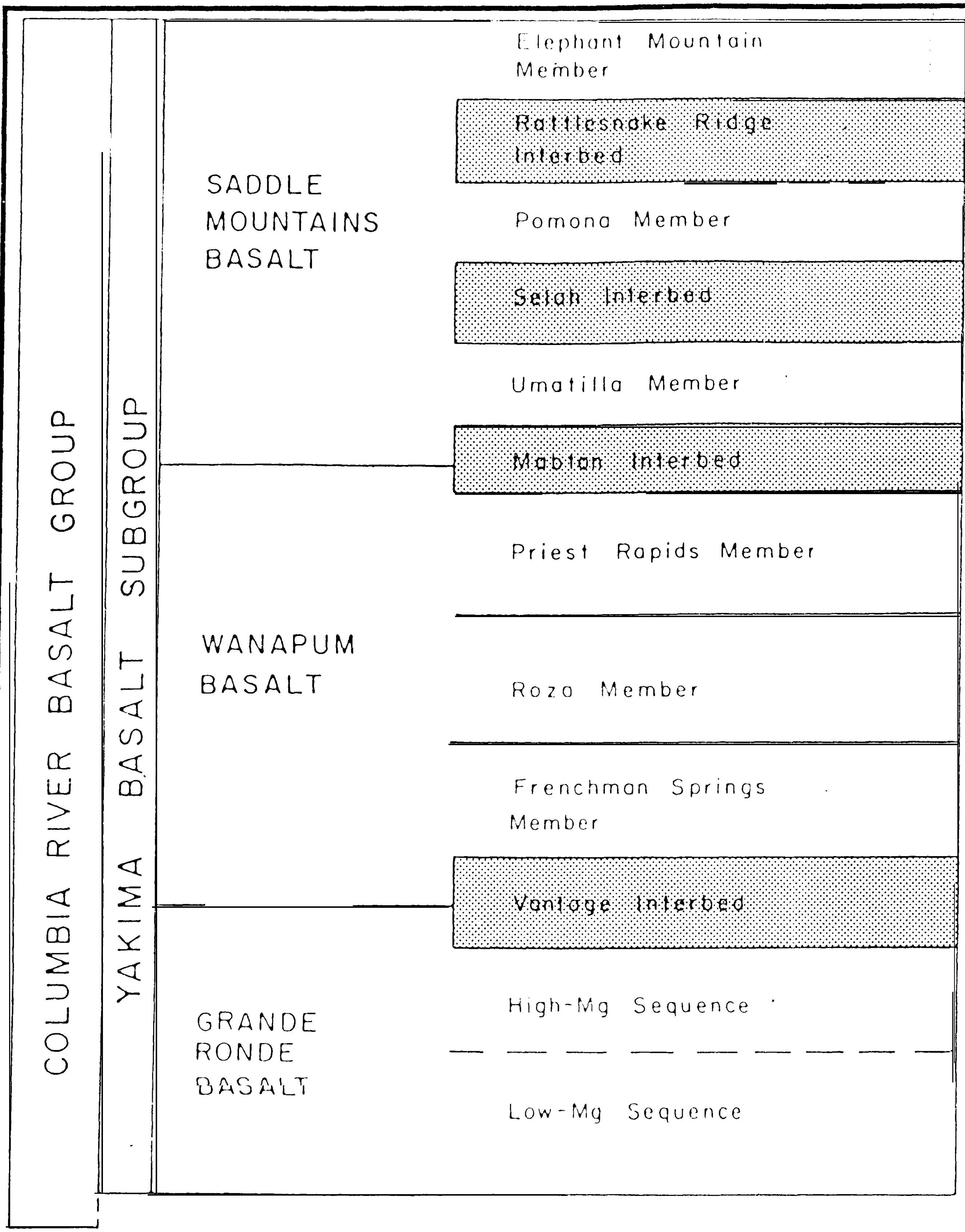



USGS TOPOGRAPHIC QUADRANGLE MAP (SCALE 1:250,000), "PENDLETON,

GeoEngineers Incorporated

**VICINITY MAP - HAT ROCK**

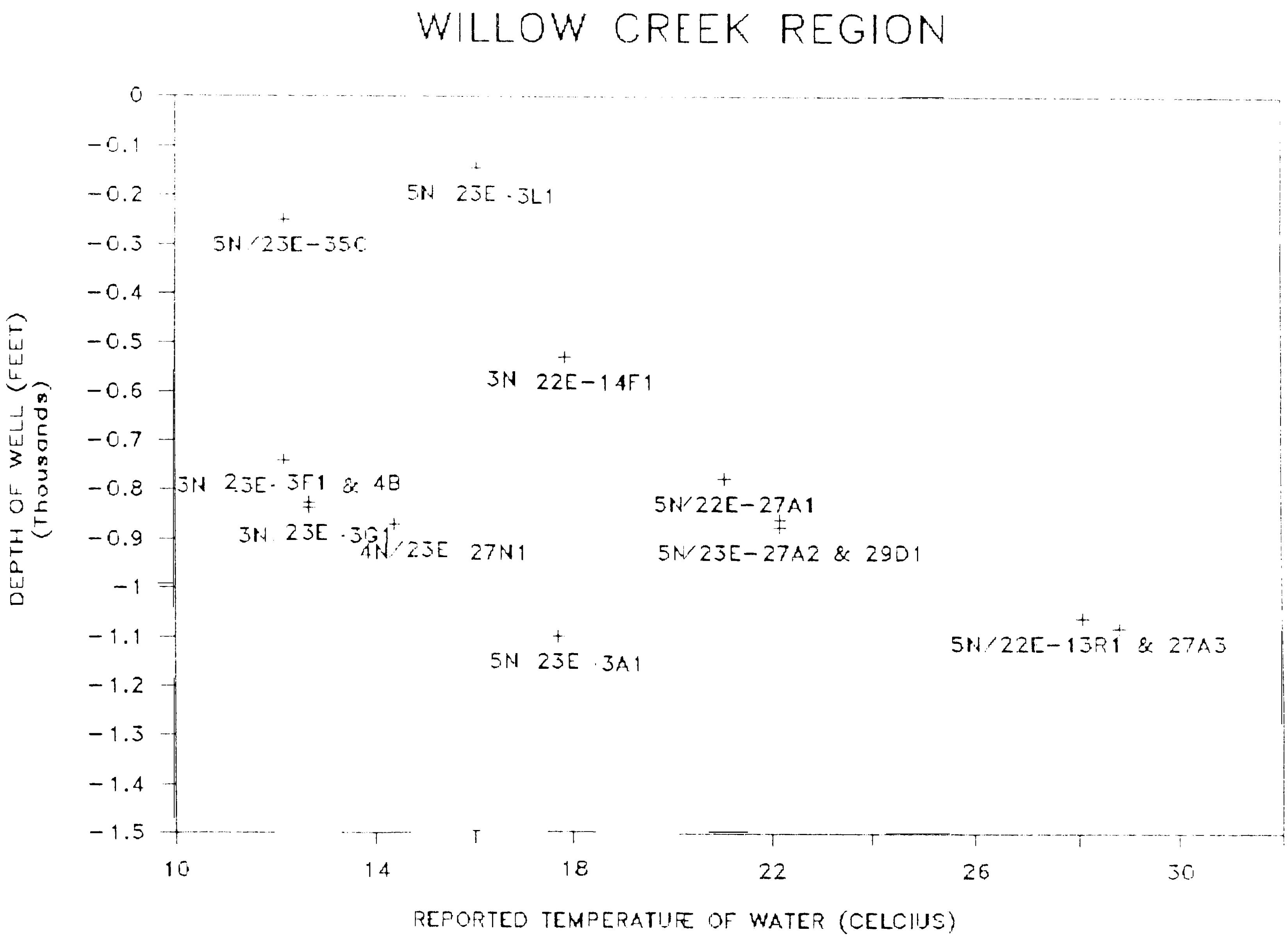
**FIGURE 2**




GeoEngineers Incorporated

STRATIGRAPHIC RELATIONSHIP AND NOMENCLATURE

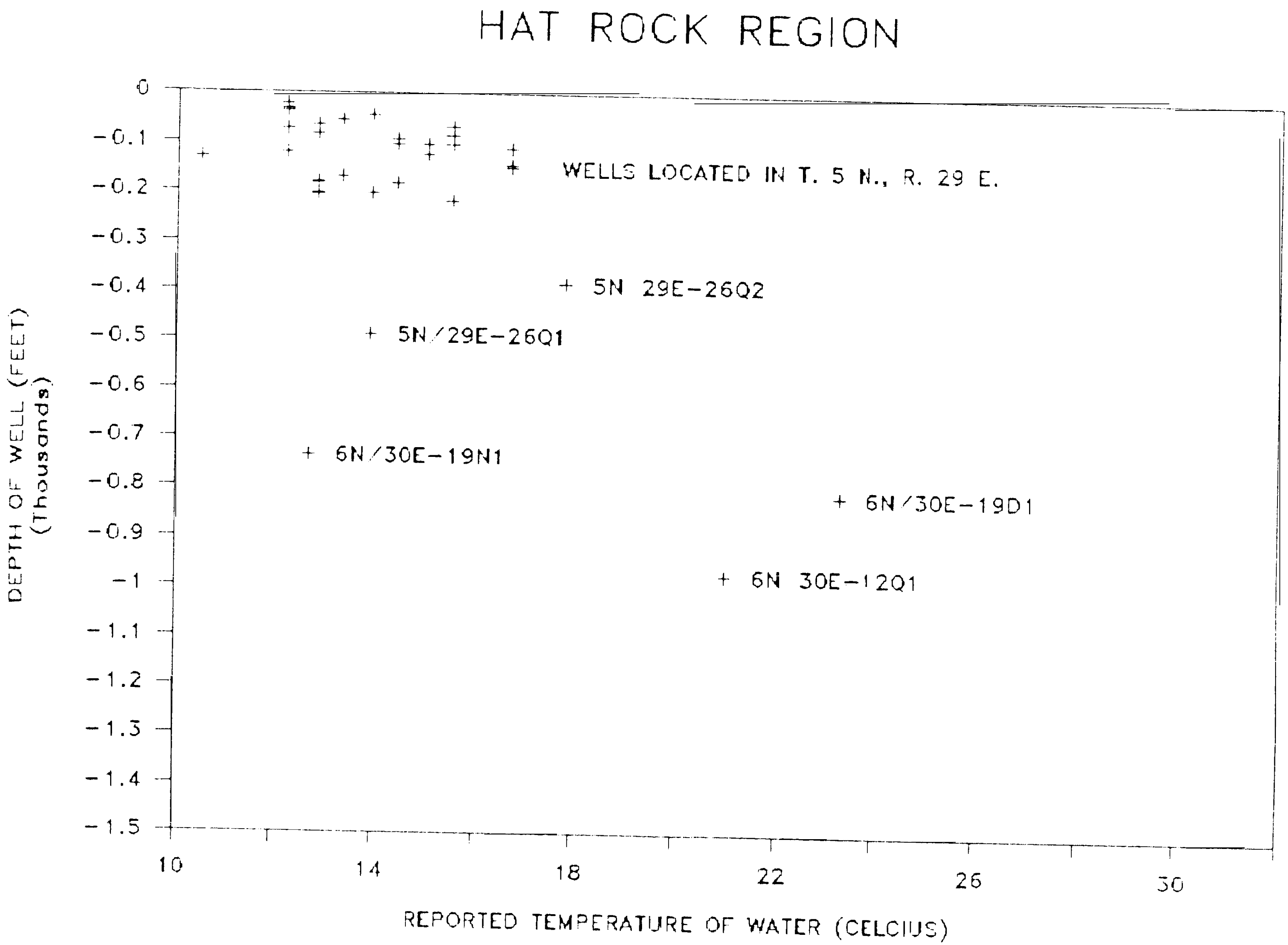
FIGURE 3




GeoEngineers Incorporated

GROUND WATER TEMPERATURE - WILLOW CR

FIGURE 4




GeoEngineers Incorporated

GROUND WATER TEMPERATURE - HAT ROCK

FIGURE 5

# APPENDIX D

# WATER QUALITY RESULTS

343

AT am test inc.

14603 N.E. 87th • REDMOND, WASHINGTON 98053 • 206/885-1664

ANALYSIS REPORT

CLIENT: Sverdrup Corporation

DATE RECEIVED: 4/24/87

REPORT TO: Gary Wiggins
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 5/15/87

| Laboratory Sample Numbers | 704320 | 704321 | 704322 |
|---|---|---|---|
| Client Identification | 3-Mile Canyon | Willow Creek | Hat Rock Well Water |
| Alkalinity (mg/l as $CaCO_3$) | 69.5 | 90.0 | 289.<br>281.] |
| Ammonia (mg/l as $NH_3$-N) | 0.080 | 0.062 | 0.028 |
| Chloride (mg/l) | 1.8 | <1. | 62.2<br>61.2] |
| Dissolved Oxygen (mg/l) | 13.2 | 13.8 | 9.6 |
| Nitrate (mg/l as $NO_3$-N) | 0.380 | 0.283 | 2.43 |
| Nitrite (mg/l) | 0.010 | 0.012 | <0.001 |
| Total Suspended Solids (mg/l) | 34. | 27. | 2. |
| Settleable Solids (mg/l) | <0.1 | 0.1 | <0.1 |
| Copper (mg/l) | 0.007 | 0.012<br>0.011] | 0.002 |
| Zinc (mg/l) | 0.120 | 0.267<br>0.267] | 0.124 |

REPORTED BY John T. Daily for
Donald Sitkei

DS/pb

am test inc.
14603 N.E. 87th • REDMOND, WASHINGTON 98053 • 206/885-1664

# ANALYSIS REPORT

CLIENT: Sverdrup

DATE RECEIVED: 5/27/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 5/31/87

| Laboratory Sample Nos. | Client Identification | Total Kjeldahl Nitrogen (mg/l) | Total Dissolved Solids (mg/l) | pH |
|---|---|---|---|---|
| 704320 | 3 Mile Canyon | 0.272 | 145. | 8.0 |
| 704321 | Willow Creek | 0.300 | 168. | 8.1 |
| 704322 | Hat Rock | <0.20<br><0.20] | 611. | 8.0<br>8.1] |
| 704874 | Ringold Spr. | <0.20 | 506. | 8.0 |
| 704875 | Ringold WW | 0.438 | 371. | 8.5 |
| 704876 | Prosser | 0.388 | 220. | 7.4 |
| 704887 | Walla Walla | 0.355 | 398. | 8.0 |

REPORTED BY ______________________
John Dailey

JD/pb

am test inc.
14603 N.E. 87th St. • REDMOND, WASHINGTON 98052 • 206/885-1664

RECEIVED
JUL 10 1987
SVERDRUP CORP.
SEATTLE OFFICE

# ANALYSIS REPORT

CLIENT: Sverdrup

DATE RECEIVED: 6/24/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 7/7/87

| Laboratory Sample Number | 707298 | 707299 | 707300 |
|---|---|---|---|
| Client Identification | Hat Rock Pond | Walla Walla River | Ringold Use Water |
| Alkalinity (mg/l as $CaCO_3$) | 221. | 180. | 261. |
| Ammonia-Nitrogen (mg/l) | 0.035 | 0.059 | 0.195 |
| Chloride (mg/l) | 17.5 | 14.9 | 34.4 |
| Dissolved Oxygen (mg/l) | 18.8 | 14.5 | 12.0 |
| Nitrate & Nitrite (mg/l) | 4.34 | 1.05 | 4.47 |
| Nitrite (mg/l) | 0.010 | 0.013 | <0.002 |
| Total Kjeldahl Nitrogen (mg/l) | <0.20 | 0.206 | <0.20<br><0.20 |
| Total Dissolved Solids (mg/l) | 440. | 380. | 630. |
| Settleable Solids (mg/l) | <0.1 | <0.1 | <0.1<br><0.1 |
| pH | 7.88 | 8.09 | 7.57 |
| Copper (mg/l) | 0.009 | 0.005 | 0.008 |
| Zinc (mg/l) | 0.044 | 0.029 | 0.025 |

REPORTED BY John T. Dailey

JTD:vh

# JOHN DAY FALL CHINOOK/SALMON MITIGATION PLAN
# ACCLIMATION AND IMPRINTING
# SITE FEASIBILITY STUDY
# RINGOLD SPRINGS SITE

Completion Report

by

U.S. FISH AND WILDLIFE SERVICE
Portland, Oregon

and

SVERDRUP CORPORATION
Bellevue, Washington

Funded by

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
DIVISION OF FISH AND WILDLIFE
CONTRACT N0.14-16-0001-84078
PROJECT NO. ________

September 1987

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## APPENDICES

# I INTRODUCTION

The Ringold Springs area is one of 10 locations being considered for an acclimation facility as part of the John Day Fall Chinook Salmon Mitigation Plan. This report presents results from an engineering feasibility study of the Ringold Springs site.

# II SITE INFORMATION

## A. Location

Ringold Springs is located adjacent to the Columbia River in Franklin County, Washington approximately 20 miles north of Pasco. The site is in Sections 24 and 25, Township 12 North, Range 28 East, at Columbia River mile 355. It is accessible on paved county roads. The general area is agricultural. The State of Washington Department of Fisheries (WDF) operates a chinook salmon rearing facility and the Washington Department of Game (WDG) has a steel-head and warm water fish rearing station at the site. Figure 1 is a Location Map and Figure 2 is a Vicinity Map for the Ringold site.

## B. Land Ownership

All land at the Ringold project site is leased from the Federal Government by the State of Washington. Two road rights-of-way owned by Franklin County cross the property. The U.S. Bureau of Reclamation owns an irrigation wasteway canal that also crosses the property. Privately owned farm land is located adjacent and to the east of the project site. Property ownership information is listed in Appendix B.

## C. Site Description

The Ringold site under consideration is roughly 2,000 feet wide from east to west and 5,200 feet long north to south, parallel to the Columbia River. On the east is a bluff parallel to the Old Ringold-Muir Road from which several springs emerge. Spring water that is not used for fish rearing flows into wet areas and eventually into a small creek that joins the Columbia. Another series of springs surface from a bluff parallel to the east-west Ringold Road and enter the irrigation wasteway. The land generally slopes from the base of the north-south bluff toward the Columbia River. The old Ringold-Muir Road runs north-south along the toe of this bluff. Ringold Road enters the property from the east. An irrigation wasteway parallels Ringold Road and crosses the property before entering the river. As mentioned, the State of Washington has existing fish rearing facilities with water supplied from the springs. There are residences, shop, and office space for employees of both Departments.

## D. Access and Services

Access to Ringold is good. There are two lane paved county roads from Pasco and there are unpaved roads to almost every location on the property. Limited services are available at Matthews Corner, roughly 5 miles south on the county road. Full services are available in Pasco, another 15 miles south.

E. Soils and Vegetation

Soils in the project area generally appear to be highly permeable sandy loam except where spring flow has deposited fine grained material. These locations are now somewhat impermeable and swampy. Bedrock outcroppings were not encountered anywhere in the project vicinity. The USDA Soil Conservation Service has not yet cataloged the Ringold area.

Vegetation consists mostly of grasses and low sage. However, there are larger trees around the spring fed wetlands and the Game Department residences.

F. Flood Levels

The Columbia River at Ringold is free flowing but still subject to regulation by upstream dams. The U.S. Department of the Army, Seattle District Corps of Engineers, has predicted 100 year recurrence interval flood levels upstream and downstream from this location. At river miles 351 and 388 the elevations are 363 and 415 feet respectively. Interpolation for Ringold at river mile 355 indicates a 100 year flood level at elevation 369. This is below elevations planned for critical fisheries facilities. Flood level information is in Appendix C.

## G. Utilities

Ringold is currently served by Benton County Public Utility District in Kennewick, Washington and by United Telephone Company, Hood River, Oregon. Domestic water for employee residences is from small diameter wells. Sewage disposal is by septic tank/soil absorption systems. Solid waste is disposed of by incineration and burial on-site.

## H. Cultural Resources

Only one site with archaeological significance (north of the present WDF facility) has been identified in the project area. However, it is possible that the south site could contain some cultural resources and therefore detailed field investigations are recommended before construction. Improvements to the existing WDF facility can be completed without investigations (refer to the Cultural Resource Overview report in the Summary Report).

## I. Existinq Fisheries Facilities

The WDF currently operates a salmon rearing station at Ringold and the WDG has steelhead and warm water fish rearing. The WDF facility consists of fourteen - 8 by 80 by 2.5 foot deep vinyl raceways and a 9 acre rearing pond. Water is from the existing springs, where there are two pipeline intakes roughly 1,200 feet apart. Intake 1 supplies an 18 inch steel pipe with 15 cfs flow. This feeds the raceways and can be diverted into the pond. Intake 2 supplies a 30 inch corrugated metal pipe (laid on the ground surface) with an additional 15 cfs flow. This pipe is connected to the raceway supply pipe. Water in the raceways can be reused in the pond. Both pipelines and their intakes have hydraulic capacity in excess of 15 cfs and the springs very likely produce more than 30 cfs. However, since the WDF water rights are limited to 15 cfs at each location, this additional capacity is not applicable. Effluent from both the raceways and pond enters the springs overflow channel before passing through a fenced adult capture/holding pond.

The WDG facility consists of open ponds for both steelhead and bass. Water supply is from spring intake 2, where WDG also has a 15 cfs right. However, at present only a portion of this is being used. The remaining water right will be used when additional facilities are constructed in the future.

Both WDF and WDG have an additional 15 cfs shared water right on the undeveloped springs. This right has permit status, which means the State has the legal right to take water. (A certificate of appropriation is not issued until the water is actually being used.) WDF has also applied for a 40 cfs right from these same springs. This application, dated November 14, 1986, is still being processed. Copies of the water rights certificate of appropriation, permit, and application are in Appendix D.

Water from the irrigation wasteway may also have potential for fish rearing, if desired. Water quality test results, which are discussed in more detail later, show that wasteway water is at least equal to spring water for the parameters that were tested.

On June 22, 3.987, estimates of flow from Springs No. 3, No. 4, and No. 5 were made using area velocity methods and culvert hydraulic measurements. The estimates are expected to be peak flows since maximum flow from the springs occurs during the summer months, starting at about the time measurements were made. Minimum flows occur during the winter and spring months. Existing data indicates that minimum flows may be approximately half of peak flows. The location and flow from the springs is reported to be changeable.

The location of the springs is shown on Figure 5. Water from s p r in n g s N 0 . 3, No. 4, and No. 5 is not being used for fish production. but flows into an irrigation water wasteway and then into the However, the WDF hatchery manager reports that water from Spring No. 5 has been successfully used for fish propagation. The estimated flow and recorded temperatures on June 22, 1987 are as Flo l oes:

| Spring | Estimated Flow | Temperature |
|---|---|---|
| No. 3 | 30 cfs | 60 F |
| No. 4 | 48 cfs | 58 F |
| No. 5 | 11 cfs | 61 F |

Field inspection of the spring sources indicated that Springs No. 3 and No. 4 were less susceptible to contamination from surface water runoff than Spring No. 5. Surface irrigation water can flow from surrounding agricultural lands and into the canyon from which Spring No. 5 originates.

## III PRODUCTION POTENTIAL

Ringold is unique from all the other sites because it has large quantities of spring water available by gravity flow. There also is a large volume of irrigation runoff water that potentially could be used if desired. However, that water has not been considered in estimates for potential fish production. From the springs, WDG has 22.5 cfs water rights and WDF has 77.5 cfs rights. Of this amount, WDG currently uses only 5 to 6 cfs and WDF about 30 cfs.

For the purpose of production estimates, the only water considered is the 77.5 cfs WDF has rights to. For these estimates, two different production scenarios were considered. They are: 1) expanding the existing WDF facility or constructing a new facility to the south, both of which would use 47.5 cfs, or 2) completely rebuilding the WDF facility and using the entire 77.5 cfs.

With 47.5 cfs, the production upon release would be 225,000 smolts at 20 per pound and 7,800,000 fry at 85 per pound. The total weight of fish would be roughly 124,000 pounds.

With 77.5 cfs, the production upon release would be 225,000 smolts at 20 per pound and 16,650,000 fry at 85 per pound. The total weight of fish would be roughly 228,000 pounds. This, of course, means that the existing WDF production is lost. But, by starting over with a new and more efficient facility, a net increase in fish production is possible. This is because the existing 9 acre WDF pond has low stocking densities and does not use water efficiently.

## IV DEVELOPMENT CONCEPTS

Three different concepts for fish rearing facilities have been evaluated for Ringold. These include expanding the existing facility by adding fifteen new vinyl raceways and two standard WDF l/2 acre asphalt lined ponds, or by constructing an entirely new facility at the same site that has ten reinforced concrete raceways and four l/2 act-e ponds. The third concept is a new facility on a new site roughly 3,200 feet south of the existing WDF raceways. It would consist of eight concrete raceways and two l/2 acre ponds. Each concept is discussed in detail in the following narrative.

Site Plans showing each concept are provided in Figures 3 to 5. Detail drawings of the proposed concrete raceways are in the Summary Report.

### A. Expand Existing Facility

This concept would include adding fifteen - 8 x 80 x 2.5 foot deep vinyl raceways and two l/2 acre asphalt lined ponds. The raceways would be built on new fill adjacent to the existing ones. This will require relocation of a portion of the existing 30 inch CMP supply pipe. The asphalt ponds would also be built on new fill west of the 9 acre pond. One pond would double for adult holding and spawning. 'This would allow the existing inadequate adult capture and holding pond to be abandoned. A food freezer and preparation building would be located centrally between the ponds and raceways. There is existing employee housing at this site and, therefore, no new housing is planned.

Water for both raceways and ponds would come from the undevelopec springs above the irrigation wasteway. A springs intake would be built near the Old Ringold-Muir Road/Ringold Road intersection. Water would be delivered in a 36 inch buried pipeline. The pipe would not be buried in Old Ringold-Muir Road (as initial inspections might indicate) because this alignment would require excessively deep excavations. Rather it would be routed west of the road through the WDG facility, where land elevations are lower. The 36 inch pipe would branch into two 24 inch pipes for supplying 27.5 cfs to the raceways and 20 cfs to the ponds.

The new raceways' drain pipe would have a manhole with slide gates so that effluent could be sent either to the 9 acre pond for reuse or directly to the drain ditch. The l/2 acre asphalt lined ponds would drain through the fish ladder to provide attraction flow for returning adults,

B. Construct New Facility at Existins Site

This concept assumes the entire 77.5 cfs would be available and therefore improve overall efficiency of water and volume use. This proposal has ten · 10 by 100 by 3.5 foot deep concrete raceways and four l/2 acre asphalt lined ponds. The raceways would be built on existing fill where the vinyl raceways are now. A food freezer and preparation building would be located adjacent to the raceways. The asphalt ponds would be constructed on new fill in the existing rearing pond. (Approximately 4 acres of pond would remain for rearing but a new outlet structure would be needed. This pond has not been included in production calculations.) One of the asphalt ponds would also serve for adult holding and spawning It would have a fish ladder leading from the existing drainage channel.

Thirty cfs of water would be supplied to the raceways by the existing 18 and 30 inch pipelines. Raceway effluent, would flow into an open concrete channel and through a buried pipeline before discharging to a drainage ditch. The ponds will be supplied with 47.5 cfs flow from a new 36 inch pipeline (the same pipeline with the same source described in the Expand Existing Facility concept). Pond effluent would og through the fi sh l adder to prov ide attraction flow for returning adults. The raceway effluent pipe could also be connected to the ponds if greater quantities of water in the ponds were required.

C. Construct New Facility at South Site

This concept has the same production capability as expanding the existing facilities, but has the advantage of a shorter pipeline length. Being removed from the existing facility may or may not be a benefit. A disadvantage is that there would be two adult capture facilities on the Columbia River within 1,700 feet of each other. The attraction water would be essentially the same and, therefore straying would be likely. Another problem is an employee residencre would be needed (to make an equal comparison with other sites) and new power and telephone service would need to be brought in. A security fence at the other two Ringold sites was not included because existing facilities are not fenced. However, one is included at this site to make an equal comparison with other sites.

This concept calls for eight concrete raceways, each 10 by 100 by 3.5 feet deep, and two l/2 acre asphalt lined ponds. One pond would double for adult holding and spawning. A fish ladder and excavated channel would connect it to the river. A 36 inch diameter water supply pipe would be fed by a springs intake at the the Ringold-Muir Road/Ringold Road intersection. The pipe would be buried and parallel to the irrigation wasteway for approximately 1,100 feet. It would cross under an existing concrete drop structure on the wasteway before entering the site.

D. Water Based Facility

Since Ringold is on a stretch of free flowing Columbia River and there are no protected embayments, floating net pens or raceways were not considered.

## V WATER QUALITY AND TEMPERATURE

On May 4, 1987, water samples were collected at the undeveloped springs and the adjacent irrigation wasteway. These were taken to AM Test, Inc., Redmond, Washington for analysis. Results are in Appendix E. Concentrations of ammonia, chloride, nitrate, total dissolved solids, and zinc in the spring water exceed the maximum levels listed in the US. Fish and Wildlife proposal to Bonneville Power Administration. Wasteway water quality also exceeds the maximum level for these same constituents.

The spring water temperature at Ringold has been very well documented over a period of 25 years. In May it ranges from an average high of 64 degrees F to an average low of 58 degrees F. The maximum May water temperature recorded was 68 degrees F. Data on average temperatures for 1969 to 1974, 1977, and 1978 are included in Appendix E. Water temperature in the wasteway was 60 degrees F on May 4, 1987.

# V COST SUMMARY

Three alternative concepts are proposed at Ringold Springs. They include expanding the existing WDF facility, constructing a new facility at the WDF site, and constructing a new facility at a south site. Construction cost summaries, exclusive of land acquisition or professional services fees; are shown in Table 1.

## TABLE 1

RINGOLD SPRINGS COST SUMMARY

| | Alt. #1 | Alt. #2 | Alt. #3 |
|---|---|---|---|
| Site Work | $ 549,800 | $ 754,500 | $ 383,000 |
| Concrete Raceways | | 308,800 | 247,000 |
| Vinyl Raceways | 169,600 | | |
| 1/2 Acre Rearing & Adult Return Pond | 186,900 | 186,900 | 186,900 |
| 1/2 Acre Rearing Ponds | 93,500 | 280,400 | 93,500 |
| Office/Housing | | | 12,500 |
| Food Freezer/Prep. Bldg.. | 73,400 | 100,000 | 73,400 |
| Standby Generator | 5,000 | 7,000 | 5,000 |
| Electric Utility | | | 4,900 |
| Telephone Utility | | | 800 |
| Subtotal | 1,078,200 | 1,637,600 | 1,007,000 |
| 15% Contingency | 161,700 | 245,600 | 151,000 |
| Total | $1,239,900 | $1,883,200 | $1,158,000 |
| Monthly Power Cost | 344 | 344 | 344 |

## VII ADVANTAGES AND DISADVANTAGES

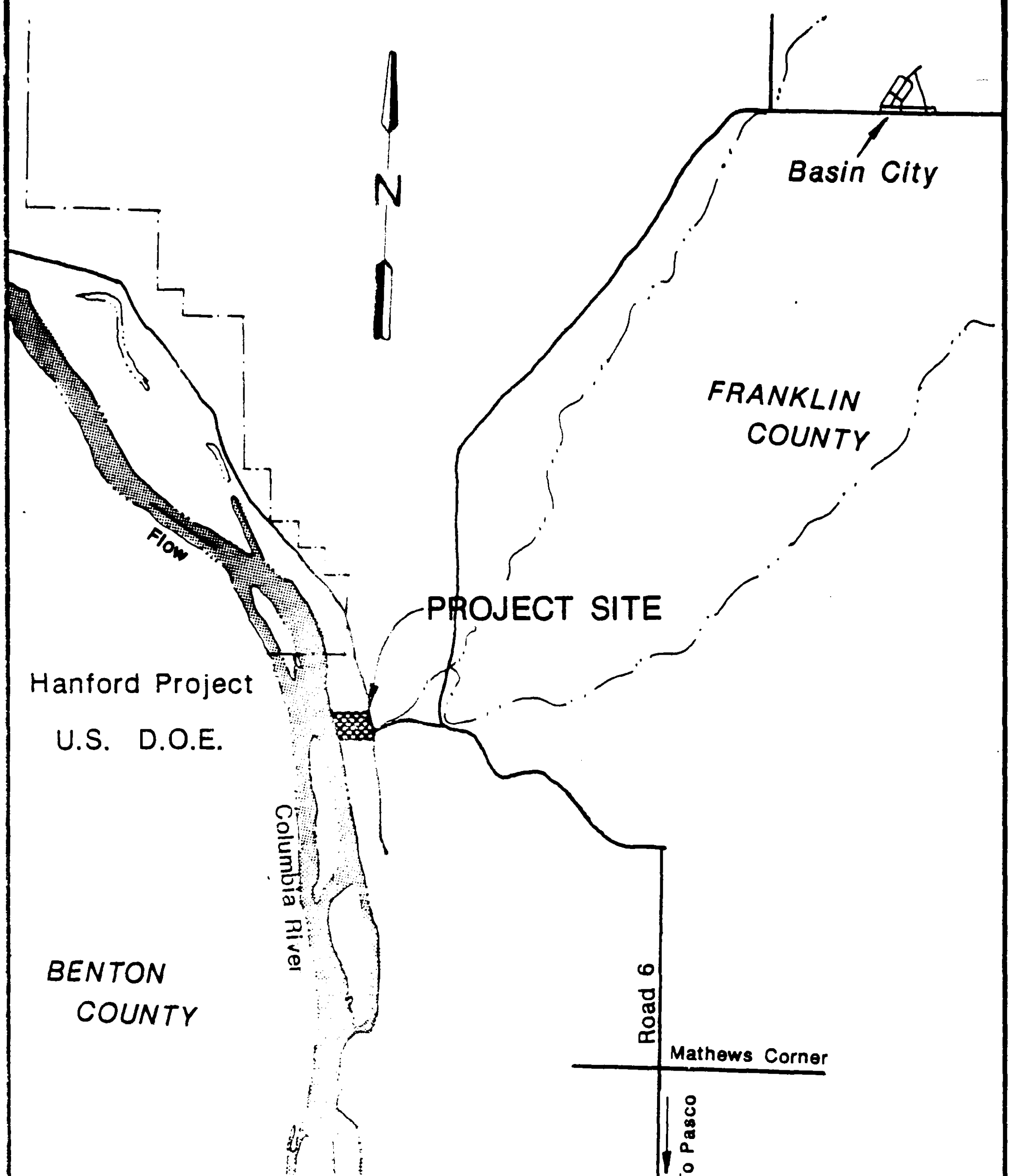
The three Ringold development alternatives have the following advanatages and disadvantages:

There is ample gravity water available.

Spring water has excess concentrations of ammonia, chloride, copper, nitrate, zinc, and total dissolved solids. However, this water has a proven history for being successful in salmon culture.

- The site for alternatives 1 and 2 is already developed with utilities, employee housing, office and shop space.
- Lowest construction cost per 1,000 pounds of fish released.
- With alternative 3 there would be 2 adult capture facilities within 1,700 feet.
- All alternatives require agreements with WDF and WDG.

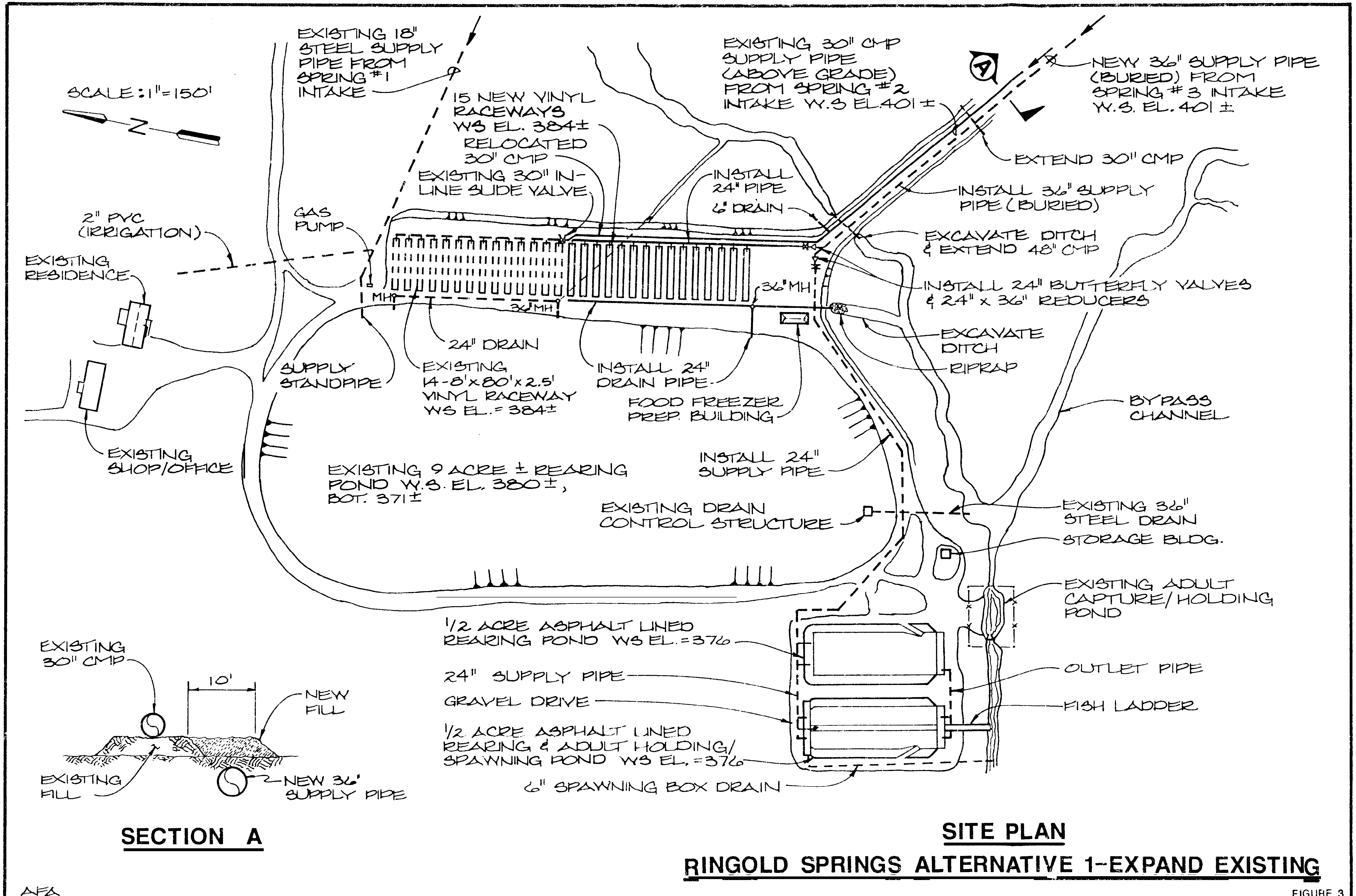
These sites are preferred based on fish health considerations.




**VICINITY MAP**
**RINGOLD SPRINGS**

SCALE: 1cm=1km

FIGURE 2

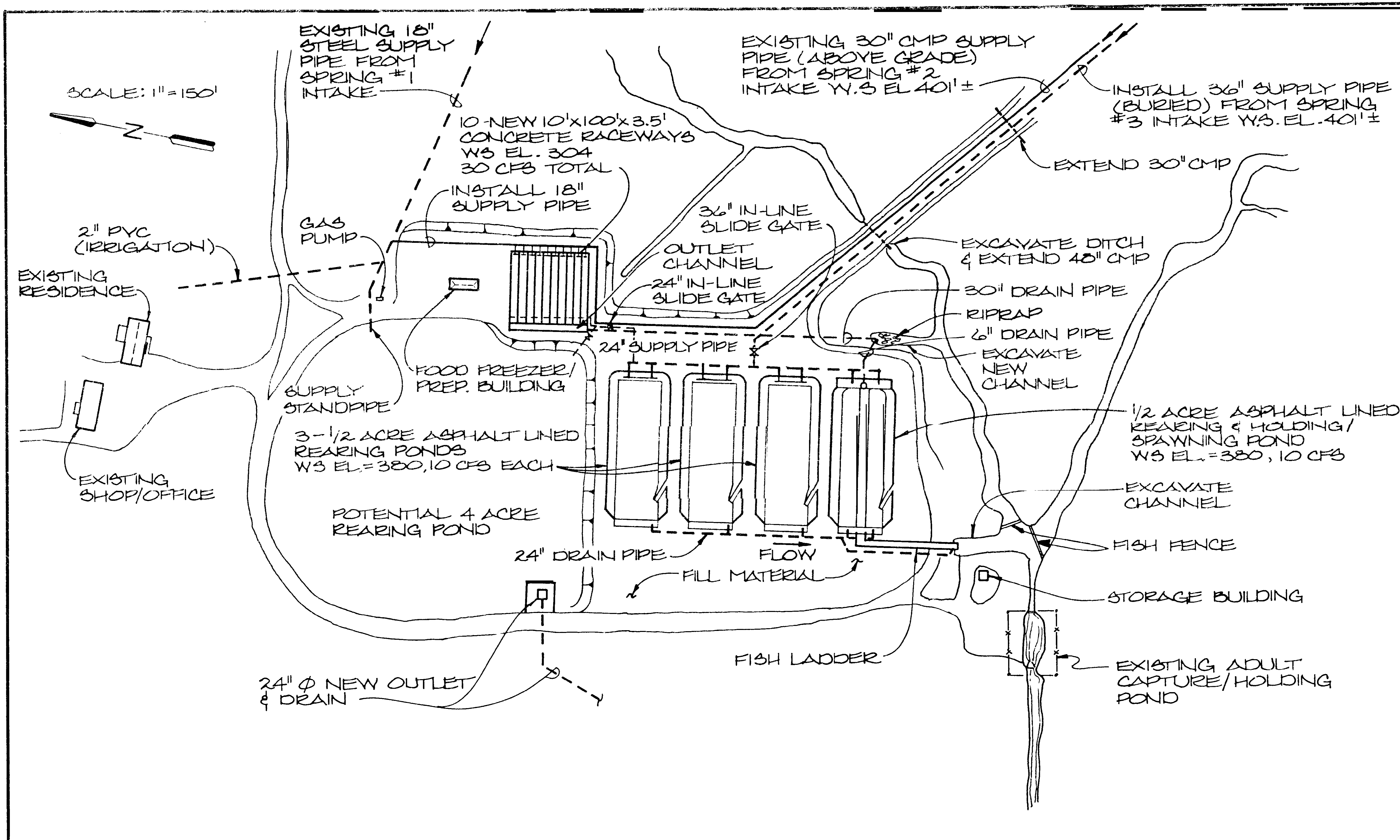



**SECTION A**

**SITE PLAN**

**RINGOLD SPRINGS ALTERNATIVE 1-EXPAND EXISTING**

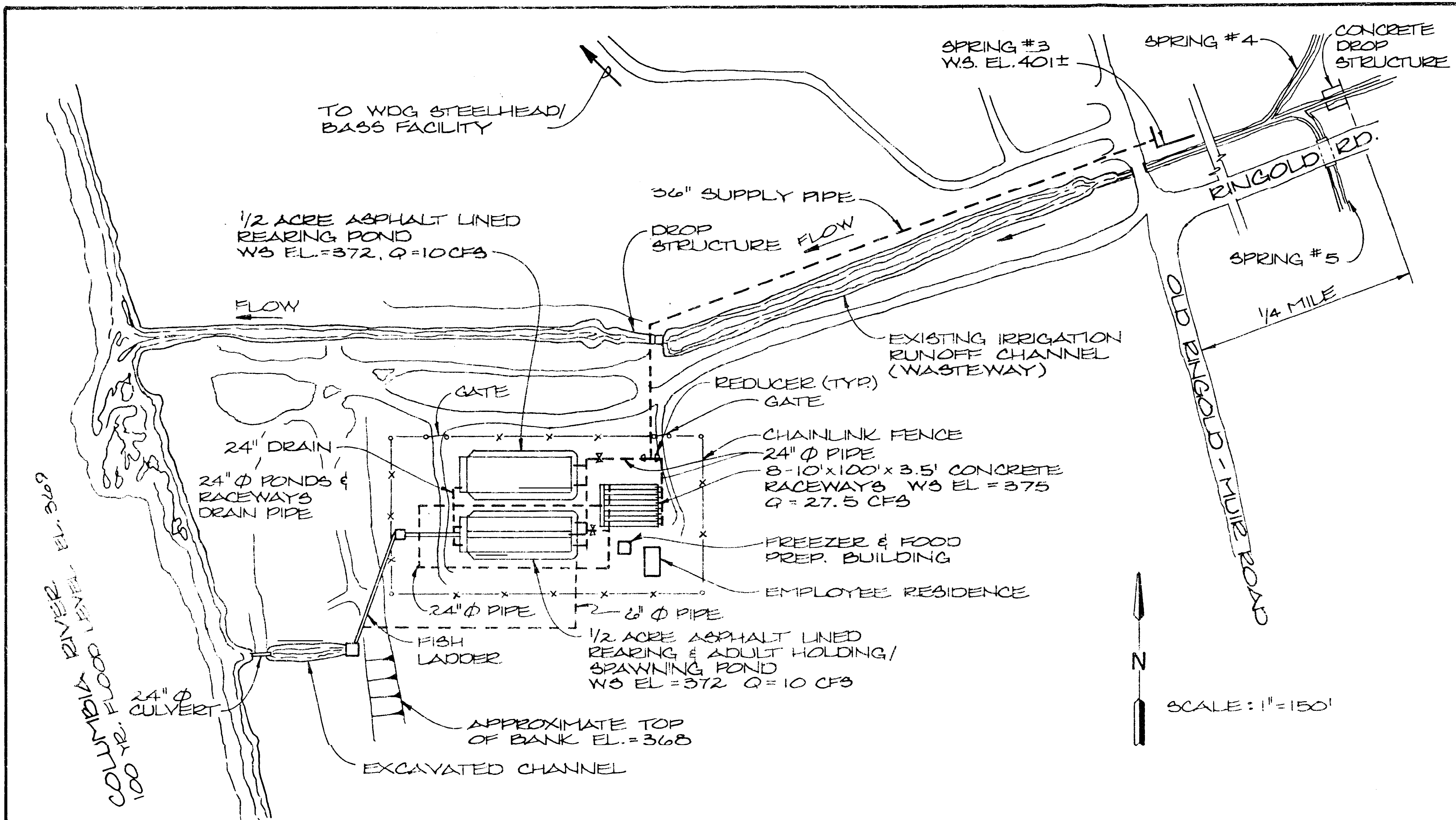
FIGURE 3




## SITE PLAN
## RINGOLD SPRINGS ALTERNATIVE 2-REBUILD EXISTING

AFA

FIGURE 4




## SITE PLAN

## RINGOLD SPRINGS ATERNATIVE 3-NEW FACILITY

AFA

FIGURE 5

# APPENDIX A

## CORRESPONDENCE

Sverdrup
CORPORATION

1200 112th Avenue. N.E.
Suite C 143
P.O. Box 369
Bellevue. Washington 98009

206 454-9562

May 21, 1987

Franklin County
Public Utility District
P.O. Box 2407
Pasco, Washington 99302

Attention: Mr. Dick Uhling

Gentlemen:

Subject: Power Service
Ringold Acclimation Facility

This is to inquire about the availability and cost for power service to a site near Ringold Springs, Franklin County on the Columbia River. The general project area is shown on the enclosed drawings.

Sverdrup is performing a chinook salmon fry rearing feasibility study for the U.S. Fish & Wildlife Service and this site is one of several being evaluated. The power requirement is approximately 3 horsepower for a fish food freezer, and a probably a 200 amp service for a residence and low level outdoor lighting. This facility will only operate during May and for 6 to 8 weeks in October and November each year.

At your earliest convenience, please send me a letter that gives an approximate cost for providing this electric service. Also, please include your power rates so that we can estimate operational costs.

Let me know if you have questions, and thank you for your assistance.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen

Enclosures

BIG BEND Electric CO-OPERATIVE, INC.

RITZVILLE, WASHINGTON 99169

June 12, 1987

Mr. Harold T. Anderson
Sverdrup Corporation
P.O. Box 369
Bellevue, WA 98009

RE: Electric Service, Ringold Acclimation Facility

Dear Mr. Anderson,

Enclosed is a proposed routing of a single phase, overhead powerline to provide electric service to the Acclimation Facility.

The approximate construction charge to provide service terminating in a Big Bend meter pole, near the proposed mobilehome site, is $4,933.00. The actual charge will be provided when we have been authorized to proceed and the line has been staked in the field.

If the metering is located within the fenced enclosure, Big Bend requires access for meter reading and service.

Enclosed, also, is a copy of our rate schedule and the contract we need signed by a U.S. Fish and Wildlife Service official which will enable us to proceed with engineering.

The final construction charge, or an authorizing purchase order, is due before construction can begin.

If you have any questions, you may contact me at Mesa (509) 265-4221.

Sincerely,

Donn M Bigelow

Donn M. Bigelow
Staking Engineer

Enclosures
ja

CC: Byron Wagner
Joe Pfeifer

SVERDRUP CORP
SEATTLE OFFICE
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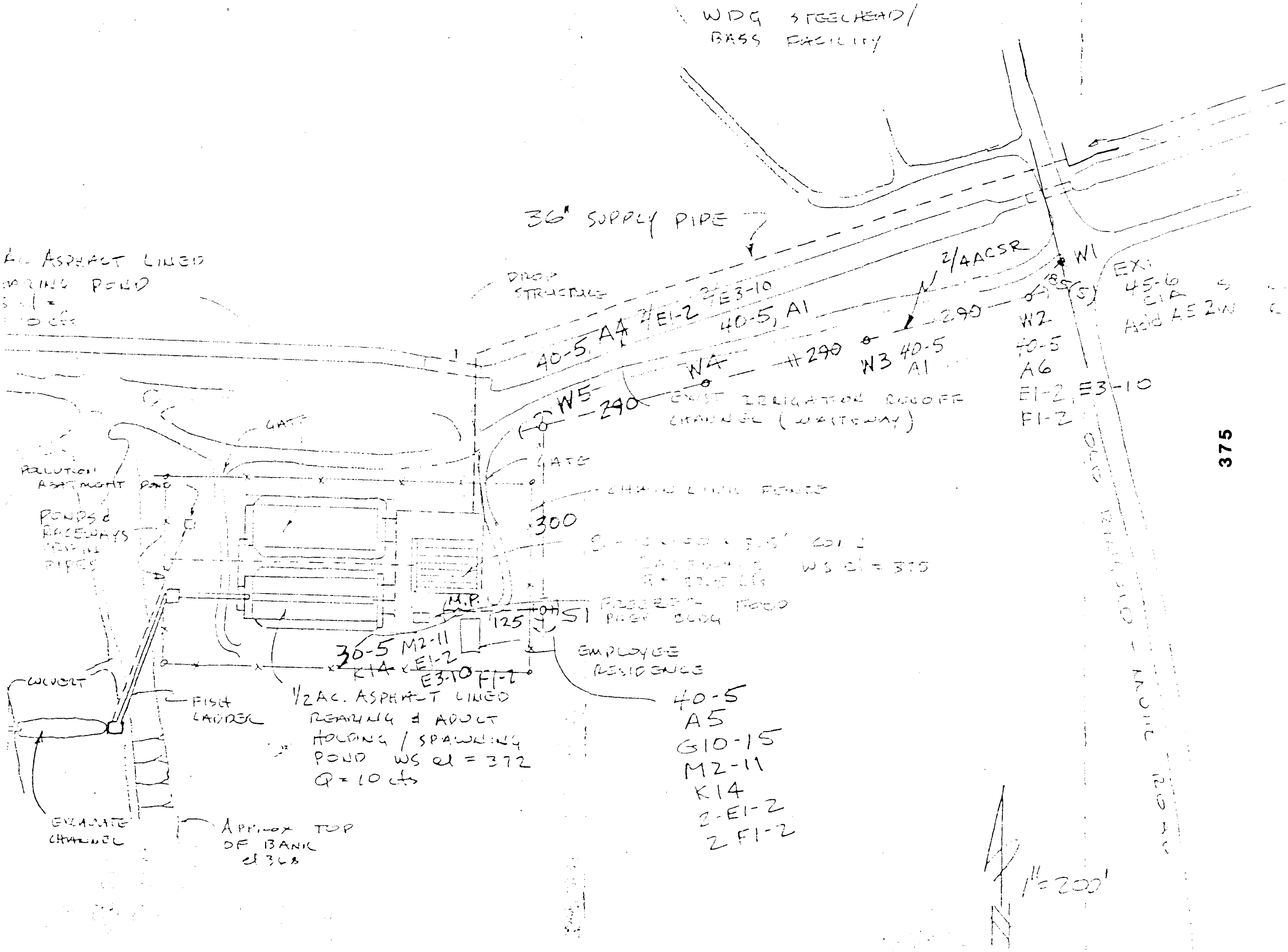
JUN 18 1987

Electrifying

YOUR FARM AND HOME



WDG STEELHEAD/
BASS FACILITY
36" SUPPLY PIPE
DROP STRUCTURE
40-5 A4
40-5, A1
2/4ACSR
W1
W2
40-5
A6
E1-2, E3-10
F1-2
W3 40-5
A1
W4
W5
290
300
EXIST IRRIGATION RUNOFF
CHANNEL (WATERWAY)
GATE
CHAIN LINK FENCE
POLLUTION
ABATEMENT POND
M.P.
125
S1
36-5 M2-11
K14 E1-2
E3-10 F1-2
EMPLOYEE
RESIDENCE
40-5
A5
G10-15
M2-11
K14
2-E1-2
2 F1-2
1/2 AC. ASPHALT LINED
REARING & ADULT
HOLDING / SPAWNING
POND WS el = 372
Q = 10 cfs
CULVERT
FISH
LADDER
EVACUATE
CHANNEL
APPROX TOP
OF BANK
el 368
1" = 200'

## General Service

*(Condensed Rates)*
*Effective July 1985 billing period*

*Availability*

Available for homes, farms, commercial, industrial, public buildings and other uses not subject to other specific rate schedules, subject to the established rules and regulations of the Cooperative.

*Monthly Charges*

Basic Charge

| | |
|---|---|
| Single-Phase | $12 |
| Multi-Phase | $16 |

Energy Charge:

| | |
|---|---|
| First 20,000 kwh | $.0344/kwh |
| Over 20,000 kwh | $.0198/kwh |

Demand Charge in excess of 50 kw: Winter (Dec.-April) at $5.33/kw. Summer (May-Nov.) at $3.60/kw
All bills shall be rounded to the nearest dollar.

*Minimum Monthly Charge*

The basic charge, plus $.40 per KVA of transformer capacity over 15 KVA, rounded to the nearest dollar.

## Irrigation Service

*(Condensed Rates)*
*Effective July 1, 1985*

*Availability*

To irrigation installations only, subject to the established rules and regulations of the Cooperative.

*Charges*

Summer Season:

| | |
|---|---|
| Facilities Charge | Includes 200 kwh/hp |
| Accounts connected prior to June 1 | $25/hp |
| Accounts connected after May 31 | $19.20/hp |
| Accounts connected after July 31 | $17.60/hp |
| OR | |
| Accounts disconnected after July 31 | $25/hp |
| Accounts disconnected prior to Aug. 1 | $21/hp |
| Accounts disconnected prior to June 1 | $18.40/hp |

Energy Charge

| | |
|---|---|
| April thru August | $.014/kwh |
| September thru October | $.017/kwh |

Winter Season: (Accounts energized for off-season use.)

| | |
|---|---|
| Facilities Charge | $80/Acct. |

Energy Charge

| | |
|---|---|
| November thru March | $.0344/kwh |

Minimum Charge:

| | |
|---|---|
| Single Phase | $128/Acct. |
| Multi-Phase | $176/Acct. |

low increases when they come.

That has to be good news in light of the fact that over 131,000 jobs are dependent on irrigated agriculture in the Northwest. We feel like we partially won this round of rate hearings, but we need to be ready for the next rate hearings to testify once again in order to protect what has been gained in the rate case.

It is inevitable that hurdles continue to pop up each time it looks like we have a clear shot at long-term stable rates—but at least for the immediate future, it appears we may be there.

Some of the hurdles that recently have shown up are the proposed acceleration of BPA repayment to the Office of Management and Budget (OMB). This proposal from David Stockman could have a very serious effect on the rates in the Northwest, since BPA obtains all of its money from the ratepayers—that means you would have to pay. Another area that could have a negative effect on the rates is if the WPPSS No. 3 lawsuit against BPA is settled in the manner discussed in John Ellis' article on compromising as a means of resolving the WPPSS lawsuit. (See pages 8 and 9).

After reviewing all the information presented, it is not easy to remember that basically the story is one of very good news. The possibility of four years without a rate increase and all the efforts in contacting the congressional delegation and organizing Co-op representatives to testify at the public rate hearings were very successful. As was the testimony of our members who took the time to speak out for a more favorable irrigation rate.

*LEFT: These charts indicate the new rates for Big Bend Electric Co-op's general service and irrigation service accounts, reflecting BPA's new wholesale rates.*

Sverdrup Corporation
1200 112th Avenue N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009
206 454-9562

June 10, 1987

Telephone Utilities of Washington
111 A Street
Cheney, Washington 99004

Attention: Ann

Dear Ann:

Subject: Telephone Service to
Ringold and White Bluffs

This is to inquire about the availability and cost for telephone service to two sites. This inquiry is being made for a feasibility study Sverdrup is doing for the U.S. Fish & Wildlife Service. We are evaluating ten sites at locations along the Columbia, Yakima and Walla Walla Rivers to determine their suitability for rearing chinook salmon fry. This work is funded by the Bonneville Power Administration and it is part of the John Day Dam salmon mitigation program. Projects actually constructed at one or more of these sites will be owned by Fish & Wildlife, and they will manage the facility or give it to the State of Washington to manage.

One location is at Ringold Springs on the Columbia River in Franklin County. The site is in the NW1/4 of Section 25, T12N, R28E. It is east of the Ringold Road/Old Ringold - Muir Road intersection. The enclosed Site Plan sketch and map should give you the exact location. We do not know where your telephone lines in this area are but they must be close. Both the Washington Departments of Game and Fisheries have fish facilities with employee housing and office space just north of our project. The Fisheries phone number is 269-4448.

The other location is at a spot on the Columbia River called White Bluffs, also in Franklin County. The site is in the NW1/4 of Section 28, T14N, R27E. It is at the old White Bluffs Ferry Crossing which is now part of the Wahluke State Wildlife Recreation Area. It is nine miles southwest of Othello on Washington State Highway 24, and on Highways 24 and 243 it is 22 miles southeast of Vantage. To reach the site from Vantage or Yakima, travel 9.3 miles east on Highway 24 from the Columbia River Vernita Bridge. Turn south onto the Wahluke Recreation Area and go 3.8 miles on an unpaved then paved road. Then turn east and go another 0.7 miles. The enclosed Site Plan sketch and map give the exact location. To my knowledge, there are no telephone lines anywhere near the White Bluffs site. If this is true and line extensions are prohibitively expensive, we will consider some sort of radio communications.

If standard telephone service is available at either site, all we need is a single line, rotary or touch tone. This phone would get infrequent use and we do not anticipate sending data or having automatic dialers in the event of emergencies.

Please review this request with your engineers and, at your earliest convenience, send me a letter that gives an approximate cost for providing this telephone service. I expect to be gone from the office for the next few weeks so if you have questions, please contact Glen Aurdahl at the phone number above.

Thank you very much for your assistance, and we look forward to hearing from you.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosures

PACIFIC TELECOM

Telephone Utilities
of Washington, Inc.
Eastern Washington Division
111 A Street
Cheney Washington
99004

Telephone
509 235 5171

June 30, 1987

SverdrupCorporation
1200 112th Avenue, N. E.
Suite C 143
PO Box 369
Bellevue, WA 98009

SUBJECT: Telephone Service to Ringold and White Bluffs

Dear Sirs:

Reference your request for availability of telephone service in the Ringold and White Bluffs area, the following information is submitted:

1. Ringold area:

   Telephone facilities would be available to this proposed site, with an estimated construction cost of $804.00, to construct approximately 1,600' of buried facilities.

2. White Bluffs area:

   This proposed site is approximately 7% miles from our nearest facilities and would require an estimated $29,304.00 in construction charges to provide physical plant approximately 39,600' in length.

Construction charges are quoted as stated by our tariff which is on file with the Washington State Utilities and Transportation Commission. This tariff provides for 528' of free construction, with the remaining portion charged at the rate of 75d per foot.

If I can be of further assistance feel free to contact me at 509-299-3107 in Medical Lake, Washington.

Sincerely,

Dale C. Rogers

Dale C. Rogers,
Field Engineer

:st

# APPENDIX B

# LAND OWNERSHIP INFORMATION

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454 9562

May 8, 1987

SHIRLEY MORROW
Franklin County Assessor
1016 North 4th
Pasco, Washington 98103
(509) 545-3506

Dear Assessor

Please send us your assessors map that covers sections 23 and 24, T12N, R28E, which is the Ringold Flats area. Enclosed is a check for $2.50 to cover the cost.

Very truly yours,

SVERDRUP CORPORATION

H T Andersen

Harold T. Andersen, P.E.

Enclosure

MAP REC'D 5/14
filed w/ rolled drwg

phoned 5/14 for owner
WDW 181.
Karl Eppich
1582 Ringold Rd.
Eltopia, Wa 99330

# APPENDIX C

## FLOW RECORDS, FLOOD PREDICTIONS

Sverdrup

1200 112th Avenue, N.E
Suite C 143
PO Box 369
Bellevue Washington 98009

206 454 9562

ay 18. 1987

.S. Army Corps of Engineers
eattle District
.O. Box C 3755
ttle, WA 98124

ttention: Mr. Ken Pick
Flood Plain Management Service

ntlemen:

Subject: Columbia River Flood Levels

Thank you for offering to provide us with Columbia River flood levels.

We are conducting a chinook salmon fry acclimation feasibility study for the U.S. Fish and Wildlife Service and we need water elevations for both 50 and 100 year recurrance interval floods. The two sites we are most interested in are White Bluffs at river mile 370 and Ringold Springs at river mile 355. Both are shown on the enclosed map.

From our phone converstation today I understand that you have predicted flood levels for river miles 388 and 351. I had hoped that your information would have been for locations closer to our sites. However, I realize we can't always have what we want.

At your convenience please send a letter that states what these elevations are. And, if you find there is additional data please send it also.

Again, thank you for your help.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX C-3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO ATTENTION OF

MAY 28 1987

Hydrology and Hydraulics Branch

Mr. Harold T. Andersen
Sverdrup Corporation
1200 112th Avenue Northeast
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

Dear Mr. Andersen:

This is in response to our telephone conversation and your May 18, 1987 letter requesting Columbia River flood levels for river miles 355 and 370.

The following elevations are based upon the best available flood profile data for this reach of the Columbia River:

| River Mile | Flood Frequency | Approximate Flood Elevation (feet NGVD) |
|---|---|---|
| 344 | 100-year | 355 |
| 351 | 100-year | 363 |
| 388 | 100-year | 415 |
| 388 | 50-year | 414 |

If you have further questions, please call me at telephone (206) 764-3661.

Sincerely,

Kenneth H. Pick

Kenneth H. Pick, P. E.
Program Manager
Flood Plain Management Services

FORM 9-207
(Rev. 11-69)

# UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

DISCHARGE MEASUREMENT SUMMARY SHEET

Station No. 12473504

Discharge measurements of Ringold Springs blw Hatchery, during the year ending Sept. 30, 1986

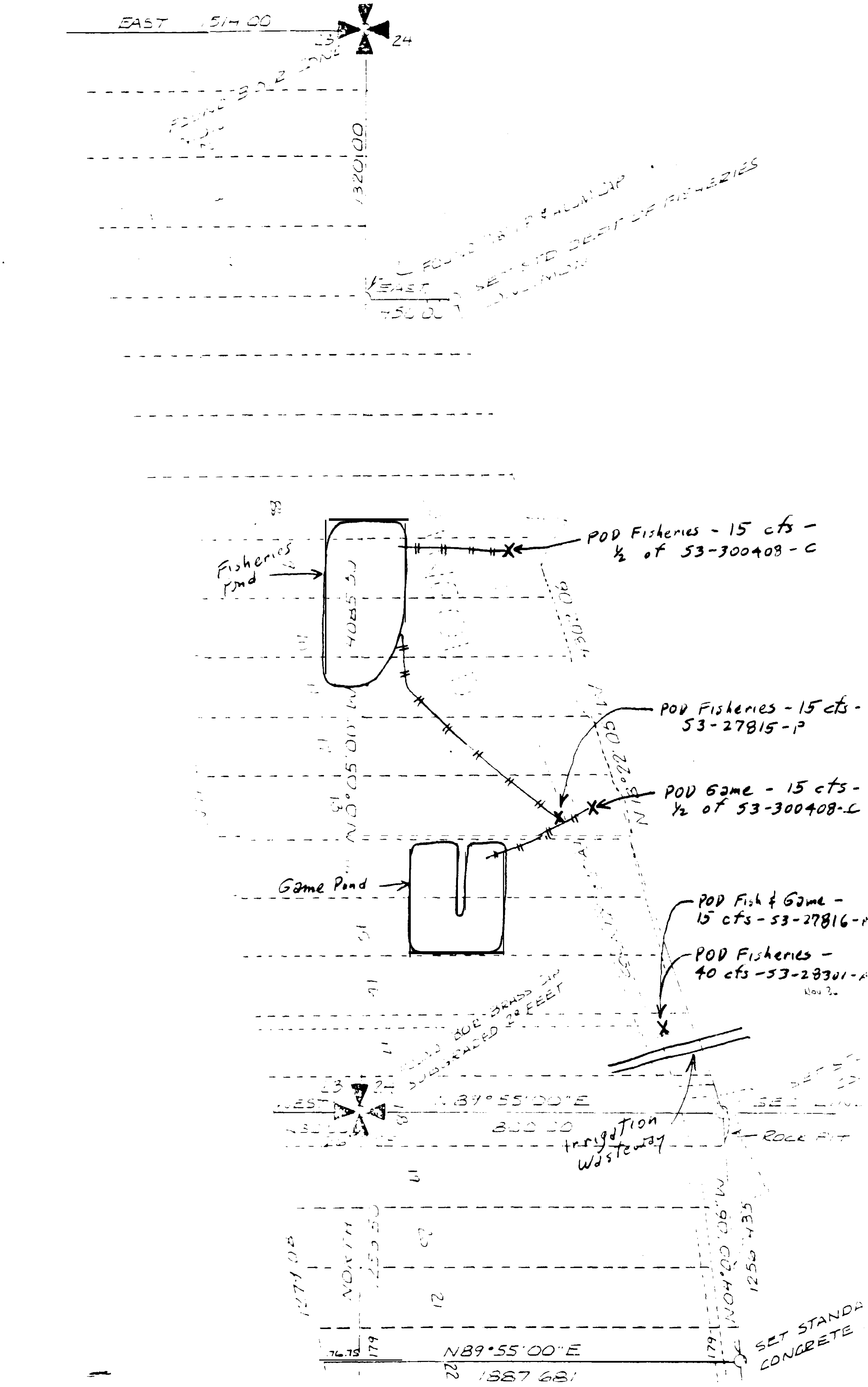
| No. | Date | Made by— | Width | Area | Mean velocity | Gage height | Discharge | Rating No. 1 Shift adj. | Percent diff. | Method | Number meas. sections | Gage height change | Time | Meas. rated | TEMP time Air °C | $H_2O$ °C | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Feet | Sq ft | Fps | Feet | Cfs | Feet | | | | Feet | Hr | | | | |
| 1 | 1986 Apr. 21 | GPRuppert | 13.6 | 6.44 | 2.28 | 4.50 | 14.7 | — | -3.9 | .6 | 26 | 0 | 1300 0.5 | F | 1304 79 | 18.0 | control: large gravel riffle 5' dn - source branch, no change |
| 2 | May 19 | do | 14.3 | 7.79 | 2.22 | 4.58 | 17.3 | — | -1.1 | .6 | 29 | 0 | 1430 0.4 | F | 1440 90 | 17.5 | control: riffle 5-10' dn - some aquatic growth |
| 3 | June 19 | do | 17.6 | 11.8 | 1.81 | 4.78 | 21.4 | -.05 | -1.8 | .6 | 27 | 0 | 1319 0.5 | F | 1323 71 | 16.9 | control: riffle 10' dn - heavy aquatic growth on left |
| 4 | July 25 | do | 17.6 | 13.6 | 1.91 | 4.90 | 26.0 | -.05 | +2.0 | .6 | 29 | 0 | 1451 0.6 | G | 1454 90 | 17.3 | control riffle 10-15' dn - bit of aquatic growth |
| 5 | Aug. 21 | do | 16.4 | 9.76 | 2.35 | 4.84 | 22.9 | -.05 | -3.0 | .6 | 29 | 0 | 1620 0.5 | F | 1624 88 | 18.6 | do |
| 6 | Sept. 22 | do | 17.0 | 9.75 | 2.30 | 4.78 | 22.4 | -.05 | +2.8 | .6 | 32 | 0 | 1158 0.7 | F | 1203 68 | 15.7 | do |
| | | | | | | | | | | | | | | | | | |
| 7 | Oct. 23 | do | 17.0 | 10.2 | 2.16 | 4.70 | 22.0 | -.05 | -1.8 | .6 | 30 | 0 | 1247 0.5 | P | °C 1250 12.4 | 13.2 | do |
| 8 | Nov. 24 | do | 8.1 | 6.29 | 2.46 | 4.57 | 15.5 | -.05 | -1.9 | .6 | 24 | 0 | 1503 0.4 | F | 1512 10.2 | 12.1 | control: riffle 1-10' dn - small amnt of aquatic growth |
| 9 | Dec. 18 | do | 9.9 | 6.38 | 2.34 | 4.46 | 14.9 | — | +4.2 | .6 | 29 | 0 | 1213 0.5 | F | 1215 2.2 | 10.2 | control: almost no aquatic growth |
| 10 | 1987 Jan 16 | do | 16.5 | 6.58 | 2.11 | 4.47 | 13.9 | — | -4.1 | .6 | 30 | 0 | 1414 0.6 | F | 1419 -6.0 | 6.2 | control: riffle 10-30' dn - clear |
| 11 | Mar. 18 | do | 11.2 | 6.21 | 2.01 | 4.40 | 15.1 | — | +2.3 | .6 | [illegible] | +.01 | 1129 0.6 | F | 1112 12.7 | 13.2 | control: very slight aquatic growth |
| 12 | Apr. 23 | do | 13.0 | 7.21 | 2.32 | 4.46 | 16.7 | +.09 | +0.6 | .6 | 31 | 0 | 1520 0.5 | G | 1523 21.6 | 17.7 | do |

Copied by .................. Computed by .................. Checked by ..................

U. S. GOVERNMENT PRINTING OFFICE · 1971 O - 441-141

# APPENDIX D

# WATER RIGHTS INFORMATION


EAST 514.00
23
24
1320.00
EAST
450.00
POD Fisheries - 15 cfs -
½ of 53-300408-C
Fisheries Pond
POD Fisheries - 15 cfs -
53-27815-P
POD Game - 15 cfs -
½ of 53-300408-C
Game Pond
POD Fish & Game -
15 cfs - 53-27816-P
POD Fisheries -
40 cfs - 53-28301-P
N89°55'00"E
800.00
Irrigation Wasteway
Rock Pit
NORTH
N0°00'06"W
1250.435
SET STANDARD CONCRETE
N89°55'00"E
1887.681
179
22

S. F. No. 389—(Rev. 6-70).

339554

Certificate Record No. ---------, Page No. S300408C

State of Washington, County of Franklin

# CERTIFICATE OF SURFACE WATER RIGHT

(In accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendment thereto, and the rules and regulations of the Department of Ecology.)

*This Is to Certify That* STATE OF WASHINGTON DEPARTMENT OF GAME STATE OF WASHINGTON DEPARTMENT OF FISHERIES

*of* Olympia, Washington, *has made proof to the satisfaction of the Department of Ecology of a right to the use of the public surface waters of the State of Washington from* Ringold Springs

*a tributary of* Columbia River, *with point of diversion within* Lot 9 and Lot 13 of Ringold Tracts

*Sec.* 24, *Twp.* 12 *N., R.* 28 E., *W.M. for the purpose(s) of* fish propagation *under and specifically subject to provisions contained in* appropriative *Permit No.* S300408P *issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of Washington, and is hereby confirmed by the Department of Ecology and entered of record in Volume* ---, *at Page* S300408C; *that the priority of the right hereby confirmed dates from* April 17, 1961; *that the quantity of water under the right hereby confirmed, for the aforesaid purposes is limited to an amount actually beneficially used and shall not exceed* 30 cubic feet per second, non-consumptive use, continuously, for fish propagation, (Department of Game 15.0 cubic feet per second; Department of Fisheries 15.0 Cubic feet per second.)

*A description of the lands to which such surface water right is appurtenant is as follows:*

Department of Fisheries:

Lots 8 to 12 inclusive, of Ringold Tracts in Sections 23 and 24, T. 12 N., R. 28 E.W.M., lying west of the county road right of way.

Department of Game:

Lots 13 to 21 inclusive, and the north 179 feet of Lot 22 of Ringold Tracts in Sections 23, 24, 25 and 26, T. 12 N., R. 28 E.W.M., lying west of the county road right of way.

*The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380 and 90.03.390.*

**This certificate of surface water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.**

*Given under my hand and the seal of this office at Olympia, Washington, this* 13th *day of* July, 19 73.

339554 RECORDED IN VOL 53 OF OFFICIAL RECORDS PAGE ____ REQUEST OF WASH. STATE DEPT ECOLOGY

JUL 16 9 00 AM '73

DOROTHY TOWNE AUDITOR FRANKLIN COUNTY, WASH. DEPUTY

MAIL TO: SEE REVERSE:

Engineering Data

OK B.F.

JOHN A. BIGGS, *Director*
Department of Ecology

by R. Jerry Bollen

R. JERRY BOLLEN
Assistant Director

1

388

33955

State of Washington Department of Ecology

# APPLICATION FOR PERMIT

## TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

[X] SURFACE WATER [ ] GROUND WATER

$10.00 MINIMUM STATUTORY EXAMINATION FEE REQUIRED WITH APPLICATION

*(GRAY BOXES FOR OFFICE USE ONLY)*

| APPLICATION NO | W.R.I.A. | COUNTY | PRIORITY DATE | TIME | ACCEPTED |
|---|---|---|---|---|---|
| 53-27815 | | Franklin | April 26 84 | | |

APPLICANT'S NAME — PLEASE PRINT: Washington State Department's of Fisheries and Game

BUSINESS TEL: SCAN 234-612
HOME TEL:

| ADDRESS (STREET) | (CITY) | (STATE) | (ZIP CODE) |
|---|---|---|---|
| 902 East Union | Olympia | WA | 98504 |

STATE & PLACE OF INCORPORATION IF APPLICANT IS A CORPORATION:

## SOURCE OF SUPPLY

| IF SURFACE WATER | IF GROUND WATER |
|---|---|
| SOURCE (NAME OF STREAM, LAKE, SPRING, ETC.) (IF UNNAMED, SO STATE): Ringold Springs | SOURCE (WELL, TUNNEL, INFILTRATION TRENCH, ETC.): |
| TRIBUTARY: Columbia River | SIZE AND DEPTH: |

## USE

USE TO WHICH WATER IS TO BE APPLIED (DOMESTIC SUPPLY, IRRIGATION, MINING, MANUFACTURING, ETC.): Fish propagation

ENTER QUANTITY OF WATER REQUESTED USING UNITS OF: CUBIC FEET PER SECOND 15 CFS **OR** GALLONS PER MINUTE GPM | ACRE FEET PER YEAR

TIMES DURING YEAR WATER WILL BE REQUIRED: Continuously

| IRRIGATION: NUMBER OF ACRES | IF DOMESTIC USE, NUMBER OF UNITS BY TYPE. E.G. 1-HOME 1-MOBILE HOME, 2-CAMPSITES ETC | IF MUNICIPAL USE, ESTIMATED POPULATION 20 YEARS FROM TODAY |
|---|---|---|
| | | |

| DATE PROJECT WAS OR WILL BE STARTED | DATE PROJECT WAS OR WILL BE COMPLETED |
|---|---|
| 1984 | 1988 |

## LOCATION OF POINT OF DIVERSION/WITHDRAWAL

### IF IN PLATTED PROPERTY

| LOT | BLOCK | OF (GIVE NAME OF PLAT OR ADDITION) | SECTION | TOWN | RANGE |
|---|---|---|---|---|---|
| 13 | | Ringold Tracts | 24 | 12 | 28E |

ALSO, PLEASE ENCLOSE A COPY OF THE PLAT AND MARK THE POINT(S) OF WITHDRAWAL OR DIVERSION

### IF NOT IN PLATTED PROPERTY

ON ACCOMPANYING SECTION MAPS, ACCURATELY MARK AND IDENTIFY EACH POINT OF DIVERSION. SHOW NORTH-SOUTH AND EAST-WEST DISTANCES FROM NEAREST SECTION CORNER OR PROPERTY CORNER

ALSO ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL

N 35° E 1950' from the SW corner of Section 24

| LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) | SECTION | TOWNSHIP N | RANGE (E OR W) W.M. | COUNTY |
|---|---|---|---|---|
| | | | | Franklin |

DO YOU OWN THE LAND ON WHICH THIS SOURCE IS LOCATED. IF NOT, INSERT NAME & ADDRESS OF OWNER

Yes

## LEGAL DESCRIPTION OF PROPERTY *ON WHICH WATER IS TO BE USED*

*ATTACH A COPY OF THE LEGAL DESCRIPTION OF THE PROPERTY (ON WHICH THE WATER WILL BE USED) TAKEN FROM* A REAL ESTATE CONTRACT, PROPERTY DEED OR TITLE INSURANCE POLICY, OR, COPY CAREFULLY IN THE SPACE BELOW

That portion of Lots 8 through 21 and the North 179' of Lot 22 of Ringold Tracts lying westerly of the county road right-of-way, in Sections 23, 24, 25 and 26, T12N, R28E., W.M.

APPLICATION

ECY 040-1-14
Rev. 1-80

WHAT IS YOUR INTEREST IN THE PROPERTY ON WHICH THE WATER IS TO BE USED (PROPERTY OWNER, LESSEE, CONTRACT PURCHASER, ETC.)

Owner

ARE THERE ANY EXISTING WATER RIGHTS RELATED TO THE LAND ON WHICH THE WATER IS TO BE USED (INCLUDING WATER PROVIDED BY IRRIGATION DISTRICTS OR DITCH COMPANIES.) see remarks ☐ YES ☐

IF YES, FROM WHAT SOURCE (i.e. SURFACE OR GROUND WATER) AND UNDER WHAT AUTHORITY

## 6. DESCRIPTION OF SYSTEM PROPOSED OR INSTALLED

(FOR EXAMPLE, SIZE OF PUMP, CAPACITY OF PUMP, PUMP MOTOR HORSE POWER, PIPE DIAMETER, NUMBER OF SPRINKLERS, ETC.)

To be designed. Probably a catch basin with pumps to deliver water to a high point on the property, then gravity to rearing ponds.

REMARKS

7. SEPA - Final DNS, Fisheries, February 15, 1984.

S3-300408-C, S3-27815-P and S3-27816-P are appurtenant to adjacent leased lands.

IF 10 ACRE-FEET OR MORE OF WATER IS TO BE STORED AND/OR IF THE WATER DEPTH WILL BE 10 FEET OR MORE AT THE DEEPEST POINT, A STORAGE PERMIT MUST BE FILED IN ADDITION TO THIS PERMIT. THESE FORMS CAN BE SECURED, TOGETHER WITH INSTRUCTIONS, FROM THE DEPARTMENT OF ECOLOGY.

## SIGNATURES

Dean Wood
APPLICANT'S SIGNATURE

Wa. State Fisheries
LEGAL LANDOWNERS NAME (PLEASE PRINT)

Dean Wood
LEGAL LANDOWNER'S SIGNATURE

902 E. Union, Olympia, WA 98504
LEGAL LANDOWNER'S ADDRESS

## FOR OFFICE USE ONLY

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY } ss.

*This is to certify that I have examined this application together with the accompanying maps and data, and am returning it for correction or completion as follows:* ..................................

..................................

..................................

*In order to retain its priority date, this application must be returned to the Department of Ecology, with corrections, on or before* ......................, 19..........

*Witness my hand this* ..............*day of*.............. 19.......

..................................
*Department of Ecology*



ECY 040-1-14

State of Washington Department of Ecology

# APPLICATION FOR PERMIT

## TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

[X] SURFACE WATER [ ] GROUND WATER

$10.00 MINIMUM STATUTORY EXAMINATION FEE REQUIRED WITH APPLICATION

(GRAY BOXES FOR OFFICE USE ONLY)

| APPLICATION NO | W.R.I.A. | COUNTY | PRIORITY DATE | TIME | ACCEPTED |
|---|---|---|---|---|---|
| S3-27816 | 36 | Franklin | April 26, 84 | | CAC |

APPLICANT'S NAME — PLEASE PRINT: Washington State Departments of Fisheries and Game

BUSINESS TEL: SCAN 234-6128

HOME TEL:

| ADDRESS (STREET) | (CITY) | (STATE) | (ZIP CODE) |
|---|---|---|---|
| 602 East Union | Olympia | WA | 98504 |

DATE & PLACE OF INCORPORATION IF APPLICANT IS A CORPORATION:

## SOURCE OF SUPPLY

| IF SURFACE WATER | IF GROUND WATER |
|---|---|
| SOURCE (NAME OF STREAM, LAKE, SPRING, ETC.) (IF UNNAMED, SO STATE): Ringold Springs | SOURCE (WELL, TUNNEL, INFILTRATION TRENCH, ETC.): |
| TRIBUTARY: Columbia River | SIZE AND DEPTH: |

## USE

USE TO WHICH WATER IS TO BE APPLIED (DOMESTIC SUPPLY, IRRIGATION, MINING, MANUFACTURING, ETC.): Fish propagation

| WATER QUANTITY OF WATER REQUESTED USING UNITS OF | CUBIC FEET PER SECOND | | GALLONS PER MINUTE | ACRE FEET PER YEAR |
|---|---|---|---|---|
| | 15 CFS | OR | GPM | |

TIMES DURING YEAR WATER WILL BE REQUIRED: Continuously

| IRRIGATION, NUMBER OF ACRES | IF DOMESTIC USE, NUMBER OF UNITS BY TYPE, E.G. 1-HOME, 1-MOBILE HOME, 2-CAMPSITES, ETC. | IF MUNICIPAL USE, ESTIMATED POPULATION 20 YEARS FROM TODAY |
|---|---|---|
| | | |

| DATE PROJECT WAS OR WILL BE STARTED | DATE PROJECT WAS OR WILL BE COMPLETED |
|---|---|
| 1984 | 1988 |

## LOCATION OF POINT OF DIVERSION/WITHDRAWAL

### IF IN PLATTED PROPERTY

| LOT | BLOCK | OF (GIVE NAME OF PLAT OR ADDITION) | SECTION | TOWN | RANGE |
|---|---|---|---|---|---|
| 5 & 17 | | Ringold Tracts | 24 | 12 | 28E |

ALSO, PLEASE ENCLOSE A COPY OF THE PLAT AND MARK THE POINT(S) OF WITHDRAWAL OR DIVERSION

### IF NOT IN PLATTED PROPERTY

ON ACCOMPANYING SECTION MAPS, ACCURATELY MARK AND IDENTIFY EACH POINT OF DIVERSION. SHOW NORTH-SOUTH AND EAST-WEST DISTANCES FROM NEAREST SECTION CORNER OR PROPERTY CORNER

ALSO ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL

N 75° E 1950' from the SW corner of Section 24

| LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) | SECTION | TOWNSHIP N | RANGE (E OR W) W.M. | COUNTY |
|---|---|---|---|---|
| | | | | Franklin |

DO YOU OWN THE LAND ON WHICH THIS SOURCE IS LOCATED. IF NOT, INSERT NAME & ADDRESS OF OWNER: Yes

## LEGAL DESCRIPTION OF PROPERTY *ON WHICH WATER IS TO BE USED*

*ATTACH A COPY OF THE LEGAL DESCRIPTION OF THE PROPERTY (ON WHICH THE WATER WILL BE USED) TAKEN FROM* REAL ESTATE CONTRACT, PROPERTY DEED OR TITLE INSURANCE POLICY, OR COPY CAREFULLY IN THE SPACE BELOW

That portion of Lots 8 through 21 and the north 179' of Lot 22 of Ringold Tracts lying westerly of the County Road right-of-way, in Sections 23, 24, 25 and 26, T12N, R28E, WM.

40-1-14



APPLICATION

WHAT IS YOUR INTEREST IN THE PROPERTY ON WHICH THE WATER IS TO BE USED (PROPERTY OWNER, LESSEE, CONTRACT PURCHASER, ETC.)

Lessee

ARE THERE ANY EXISTING WATER RIGHTS RELATED TO THE LAND ON WHICH THE WATER IS TO BE USED (INCLUDING WATER PROVIDED BY IRRIGATION DISTRICTS OR DITCH COMPANIES) ☒ YES ☐ NO

YES, FROM WHAT SOURCE (i.e. SURFACE OR GROUND WATER) AND UNDER WHAT AUTHORITY

S-300408-C issued jointly to Washington State Departments of Fisheries and Game

## DESCRIPTION OF SYSTEM PROPOSED OR INSTALLED

(FOR EXAMPLE, SIZE OF PUMP, CAPACITY OF PUMP, PUMP MOTOR HORSE POWER, PIPE DIAMETER, NUMBER OF SPRINKLERS, ETC.)

To be designed. A catch basin will be constructed with gravity pipeline or pipelines to existing and expanded fish rearing facilities.

REMARKS

SEPA - Checklist in process.

Quantity requested is additional over existing certificate and concurrent application.

Copies of lease with Bureau of Reclamation, agreement with the County, and Fisheries and Game Interagency Agreement are enclosed.

IF 10 ACRE-FEET OR MORE OF WATER IS TO BE STORED AND/OR IF THE WATER DEPTH WILL BE 10 FEET OR MORE AT THE DEEPEST POINT, A STORAGE PERMIT MUST BE FILED IN ADDITION TO THIS PERMIT. THESE FORMS CAN BE SECURED, TOGETHER WITH INSTRUCTIONS, FROM THE DEPARTMENT OF ECOLOGY.

## SIGNATURES

FISHERIES: Dean Ford

GAME : Roger Bogden

APPLICANT'S SIGNATURE

Bureau of Reclamation
LEGAL LANDOWNERS NAME
(PLEASE PRINT)

LEGAL LANDOWNER'S SIGNATURE

LEGAL LANDOWNER'S ADDRESS

## FOR OFFICE USE ONLY

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY } ss.

*This is to certify that I have examined this application together with the accompanying maps and data, and am returning it for correction or completion as follows:* ..........................................

..........................................

..........................................

*In order to retain its priority date, this application must be returned to the Department of Ecology, with corrections, on or before*........................ *19*...........

*Witness my hand this*.............. *day of*............... *19*.......

..................................
*Department of Ecology*

State of Washington Department of Ecology

# APPLICATION FOR PERMIT
## TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☒ SURFACE WATER ☐ GROUND WATER

$10.00 MINIMUM STATUTORY EXAMINATION FEE REQUIRED WITH APPLICATION

*(GRAY BOXES FOR OFFICE USE ONLY)*

| APPLICATION NO | W.R.I.A. | COUNTY | PRIORITY DATE | TIME | ACCEPTED |
|---|---|---|---|---|---|
| 53-23301 | 36 | Franklin | Nov 14, 1986 | | CAC |

APPLICANT'S NAME — PLEASE PRINT: Washington State Department of Fisheries

BUSINESS TEL. 753-6128

HOME TEL.

ADDRESS (STREET) (CITY) (STATE) (ZIP CODE): 902 East Union, Olympia, WA 98504

DATE & PLACE OF INCORPORATION IF APPLICANT IS A CORPORATION:

## 1. SOURCE OF SUPPLY

| IF SURFACE WATER | IF GROUND WATER |
|---|---|
| SOURCE (NAME OF STREAM, LAKE, SPRING, ETC.) (IF UNNAMED, SO STATE): Ringold Springs | SOURCE (WELL, TUNNEL, INFILTRATION TRENCH, ETC.): |
| TRIBUTARY: Columbia River | SIZE AND DEPTH: |

## 2. USE

USE TO WHICH WATER IS TO BE APPLIED (DOMESTIC SUPPLY, IRRIGATION, MINING, MANUFACTURING, ETC.): Fish propagation

ENTER QUANTITY OF WATER REQUESTED USING UNITS OF: CUBIC FEET PER SECOND 40 CFS **OR** GALLONS PER MINUTE ____ GPM ACRE FEET PER YEAR

TIMES DURING YEAR WATER WILL BE REQUIRED: continuously

| IF IRRIGATION, NUMBER OF ACRES | IF DOMESTIC USE, NUMBER OF UNITS BY TYPE, E.G. 1-HOME, 1-MOBILE HOME, 2-CAMPSITES, ETC. | IF MUNICIPAL USE, ESTIMATED POPULATION 20 YEARS FROM TODAY |
|---|---|---|
| | | |

| DATE PROJECT WAS OR WILL BE STARTED | DATE PROJECT WAS OR WILL BE COMPLETED |
|---|---|
| 1989 | 1991 |

## 3. LOCATION OF POINT OF DIVERSION/WITHDRAWAL

### 3A. IF IN PLATTED PROPERTY

| LOT | BLOCK | OF (GIVE NAME OF PLAT OR ADDITION) | SECTION | TOWN | RANGE |
|---|---|---|---|---|---|
| 16 & 17 | | Ringold Tracts | 24 | 12 | 28E |

ALSO, PLEASE ENCLOSE A COPY OF THE PLAT AND MARK THE POINT(S) OF WITHDRAWAL OR DIVERSION

### 3B. IF NOT IN PLATTED PROPERTY

ON ACCOMPANYING SECTION MAPS, ACCURATELY MARK AND IDENTIFY EACH POINT OF DIVERSION. SHOW NORTH-SOUTH AND EAST-WEST DISTANCES FROM NEAREST SECTION CORNER OR PROPERTY CORNER.

ALSO, ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL

N. 71° E 1600' from the SW corner of Sec. 24

| LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) | SECTION | TOWNSHIP N. | RANGE (E. OR W.) W.M. | COUNTY |
|---|---|---|---|---|
| | | | | Franklin |

4. DO YOU OWN THE LAND ON WHICH THIS SOURCE IS LOCATED. IF NOT, INSERT NAME & ADDRESS OF OWNER

yes

## 5. LEGAL DESCRIPTION OF PROPERTY *ON WHICH WATER IS TO BE USED*

*ATTACH A COPY OF THE LEGAL DESCRIPTION OF THE PROPERTY (ON WHICH THE WATER WILL BE USED) TAKEN FROM* A REAL ESTATE CONTRACT, PROPERTY DEED OR TITLE INSURANCE POLICY, OR, COPY CAREFULLY IN THE SPACE BELOW.

That part of lots 5, 6 and 7 of Ringold tracts lying westerly of county road R/W, within Sections 23 and 24, T12N, R28E WM.

APPLICAT

IS YOUR INTEREST IN THE PROPERTY ON WHICH THE WATER IS TO BE USED (PROPERTY OWNER, LESSEE, CONTRACT PURCHASER, ETC.)

Lessee

ARE THERE ANY EXISTING WATER RIGHTS RELATED TO THE LAND ON WHICH THE WATER IS TO BE USED (INCLUDING WATER PROVIDED BY IRRIGATION DISTRICTS OR DITCH COMPANIES.) [X] YES [ ] NO

YES, FROM WHAT SOURCE (i.e. SURFACE OR GROUND WATER) AND UNDER WHAT AUTHORITY

S-300408-C issued jointly to Washington State Departments of Fisheries and Game.

## DESCRIPTION OF SYSTEM PROPOSED OR INSTALLED

(FOR EXAMPLE: SIZE OF PUMP, CAPACITY OF PUMP, PUMP MOTOR HORSE POWER, PIPE DIAMETER, NUMBER OF SPRINKLERS, ETC.)

To be designed. A catch basin will be constructed with gravity pipelines to existing and expanded fish rearing facilities.

REMARKS

SEPA - Final DNS, Fisheries, February 15, 1984. Quantity requested is additional over existing certificate and concurrent application. Copies of lease with Bureau of Reclamation, Agreement with the County, and Fisheries and Game Interagency Agreement are enclosed.

IF 10 ACRE-FEET OR MORE OF WATER IS TO BE STORED AND/OR IF THE WATER DEPTH WILL BE 10 FEET OR MORE AT THE DEEPEST POINT, A STORAGE PERMIT MUST BE FILED IN ADDITION TO THIS PERMIT. THESE FORMS CAN BE SECURED, TOGETHER WITH INSTRUCTIONS, FROM THE DEPARTMENT OF ECOLOGY

## SIGNATURES

FISHERIES: Dean Wood

GAME: Jorge Bryden

APPLICANT'S SIGNATURE

Bureau of Reclamation

LEGAL LANDOWNERS NAME (PLEASE PRINT)

LEGAL LANDOWNER'S SIGNATURE

LEGAL LANDOWNER'S ADDRESS

## FOR OFFICE USE ONLY

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY } *ss.*

*This is to certify that I have examined this application together with the accompanying maps and data, and am returning it for correction or completion as follows:* ........................................

........................................................................................................

........................................................................................................

*In order to retain its priority date, this application must be returned to the Department of Ecology, with corrections, on or before*......................., *19*...........

*Witness my hand this*...............*day of*.............., *19*.......

..................................
*Department of Ecology*

# APPENDIX E

## WATER QUALITY RESULTS

am test inc.
14603 N.E. 87th • REDMOND, WASHINGTON 98053 • 206/885-1664

# ANALYSIS REPORT

CLIENT: Sverdrup

DATE RECEIVED: 5/27/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 5/31/87

| Laboratory Sample Nos | Client Identification | Total Kjeldahl Nitrogen (mg/l) | Total Dissolved Solids (mg/l) | pH |
|---|---|---|---|---|
| 704320 | 3 Mile Canyon | 0.272 | 145. | 8.0 |
| 704321 | Willow Creek | 0.300 | 168. | 8.1 |
| 704322 | Hat Rock | <0.20<br><0.20] | 611. | 8.0<br>8.1] |
| 704874 | Ringold Spr | <0.20 | 506. | 8.0 |
| 704875 | Ringold WW | 0.438 | 371. | 8.5 |
| 704876 | Prosser | 0.388 | 220. | 7.4 |
| 704887 | Walla Walla | 0.355 | 398. | 8.0 |

REPORTED BY [signature]
John Dailey

JD/pb

am test inc.

14603 N.E. 87th St. • REDMOND, WASHINGTON 98052 • 206/885-1664

ANALYSIS REPORT

CLIENT: Sverdrup Corporation

DATE RECEIVED: 5/6/87 (704887)
5/5/87 (704874-876)

REPORT TO: Gary Wiggins
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 5/26/87

| Laboratory Sample Number | 704874 | 704875 | 704876 | 704877 |
|---|---|---|---|---|
| Client Identification | Ringold Spring | Ringold W W | Prosser | Walla Walla |
| Alkalinity (mg/l as $CaCO_3$) | 228. | 169. | 50. | 254. |
| Ammonia (mg/l) | 0.018 ] 0.017 | 0.059 | 0.054 | 0.077 |
| Chloride (mg/l) | 27. | 16. | <1.0 | 11. |
| Dissolved Oxygen (mg/l) | 15.1 | 9.9 | 12.8 | 11.4 |
| Nitrate & Nitrite (mg/l) | 4.30 | 2.41 | 0.440 | 0.97 |
| Nitrite (mg/l) | <0.002 | 0.019 ] 0.019 | 0.011 | 0.011 |
| Total Suspended Solids (mg/l) | 3. | 32. | 107. | 12. |
| Settleable Solids (mg/l) | <0.1 | 0.1 | 0.7 | <0.1 |
| Copper (mg/l) | 0.003 | 0.002 | 0.003 | 0.002 |
| Zinc (mg/l) | 0.033 | 0.042 | 0.065 | 0.028 |

] - indicates duplicate analysis.

REPORTED BY John T. Dailey
John T. Dailey

JTD:vb

AT am test inc.
14603 N.E. 87th St. • REDMOND, WASHINGTON 98052 • 206/885-1664

RECEIVED
JUL 10 1987
SVERDRUP CORP.
SEATTLE OFFICE

ANALYSIS REPORT

CLIENT: Sverdrup

DATE RECEIVED: 6/24/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 7/7/87

| Laboratory Sample Number | 707298 | 707299 | 707300 |
|---|---|---|---|
| Client Identification | Hat Rock Pond | Walla Walla River | Ringold waste way Use Water |
| Alkalinity (mg/l as $CaCO_3$) | 221. | 180. | 261. |
| Ammonia-Nitrogen (mg/l) | 0.035 | 0.059 | 0.195 |
| Chloride (mg/l) | 17.5 | 14.9 | 34.4 |
| Dissolved Oxygen (mg/l) | 18.8 | 14.5 | 12.0 |
| Nitrate & Nitrite (mg/l) | 4.34 | 1.05 | 4.47 |
| Nitrite (mg/l) | 0.010 | 0.013 | <0.002 |
| Total Kjeldahl Nitrogen (mg/l) | <0.20 | 0.206 | <0.20<br><0.20 |
| Total Dissolved Solids (mg/l) | 440. | 380. | 630. |
| Settleable Solids (mg/l) | <0.1 | <0.1 | <0.1<br><0.1 |
| pH | 7.88 | 8.09 | 7.57 |
| Copper (mg/l) | 0.009 | 0.005 | 0.008 |
| Zinc (mg/l) | 0.044 | 0.029 | 0.025 |

REPORTED BY John T. Dailey
John T. Dailey



JTD:vb

JOHN DAY FALL CHINOOK/SALMON MITIGATION PLAN
ACCLIMATION AND IMPRINTING
SITE FEASIBILITY STUDY
WILLOW CREEK SITE
(With Alternative Three Mile Canyon Site)

Completion Report

by

U.S. FISH AND WILDLIFE SERVICE
Portland, Oregon

and

SVERDRUP CORPORATION
Bellevue, Washington

Funded by

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
DIVISION OF FISH AND WILDLIFE
CONTRACT NO. 14-16-0001-84078
PROJECT No. ______

September 1987

TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## APPENDICES

# I INTRODUCTION

The Willow Creek area (which includes an alternative site at Three Mile Canyon) is one of 10 locations being considered for an acclimation facility as part of the John Day Fall Chinook Salmon Mitigation Plan. This report presents results from an engineering feasibility study of the Willow Creek/Three Mile Canyon sites.

## II WILLOW CREEK SITE INFORMATION

### A. Location

The Willow Creek site is on a backwater of the Columbia River John Day Dam Pool. It is in Gilliam County, Oregon approximately 17 miles east of Boardman, Oregon on Interstate Highway 84, Sections 25 and 36, Township 4 North, Range 22 East. The backwater is a pond having approximately 315 acres of surface area. It opens to the Columbia River on the north and is fed by Willow Creek entering from the south. Interstate 84 and the Union Pacific Railroad cross the backwater on three bridges adjacent to the river. The Union Pacific Heppner Branch is adjacent to the west shore of the backwater. The area is all undeveloped except for a large irrigation pump station at the south end of the backwater. Figure 1 is a Location Map and Figure 2 is a Vicinity Map for Willow Creek.

### B. Land Ownership

All land in the project vicinity except for the railroad and highway rights-of-way is owned by the Federal Government.

### C. Site Description

The Willow Creek backwater area is undeveloped rangeland. The average annual temperature is 52 to 54 degrees Fahrenheit (F) and the average annual rainfall is 7 to 8 inches. Elevations vary from

265, which is the normal John Day Pool level, to roughly 480 on the east side. Slopes vary from I to 20 percent, with an average of about 10 percent. The backwater adjacent to the river is crossed by Interstate 84 and the Union Pacific Railroad. The 2,000 feet of total crossing width is mostly on fill. The railroad bridge span is about 500 feet, while the east and west bound highway bridges span 250 feet. Horizontal and vertical clearance between pilings is 65 and 10 feet, respectively. The Union Pacific Heppne Branch tracks are adjacent to the east backwater shore. Oregon State Highway 74 intersects Interstate 84 1.2 miles west of the Willow Creek bridges. From the interstate it is 40 miles south on Highway 74 to Hppner, Oregon. The community of Arlington, Oregon is about 10 miles west on Interstate 84.

D. Access and Services

There is only one potential building site at Willow Creek and access to it would be difficult. Interstate Highway 84 has restricted ingress/egress and a new road leaving the interstate would not be permitted. Oregon State Highway 74 has controlled access and special permission for a new intersection is required. To obtain permission it is either necessary to abandon an existing access to the same parcel of property or to make a cash payment to the State of Oregon. To intersect Highway 74, a new access road roughly one mile long would have to be constructed. It would cross the Union Pacific Heppner Branch and, therefore, permission from the railroad would also be necessary. The closest location with goods and services is Arlington, Oregon.

E. Soils and Vegeation

The USDA Soil Conservation Service classifies site materials as the Quincy-Rock Outcrop complex. The complex is about 60 percent dark grayish brawn loamy fine sand with high permeability and 25 percent basalt bedrock outcrop. The remaining 15 or so percent is Olex and Roloff soils that are similar to Quincy soil but underlain by basalt at a depth of less than 60 inches. Erosion potential of this soil is low but the hazard of soil blowing is high.

Vegetation consists of grasses and shrubs. There are no trees.

F. Flood Levels

The normal maximum John Day Pool elevation is 265. A 100-year recurrence interval flood, or 1,200,000 cubic feet per second (cfs), would raise the pool elevation at Willow Creek to an approximate elevation of 266.6 feet. The minimum pool level for pump and fish ladder design is elevation 257.

The minimum, maximum, and mean Willow Creek discharge for May is 0, 194, and 47 cfs respectively. A 25-year recurrence interval flood is predicted to have a 21,900 cfs discharge. There is no information available for a 100-year flood. Flow and flood data are based upon U.S. Department of the Interior Geological Survey gaging information from August 1960 to September 1979.

There is a large irrigation pump station located at the south end of the Willow Creek backwater. It is owned by P.T. Taggares Farms, Boardman, Oregon. They pump up to 160,000 gallons per minute (355 cfs) and operate continuously from March I5 to November 1 each year. On April 24, 1987, the reported pumping rate was 50,000 gpm, creating a noticeable current from the river into the backwater.

G. Utilities

There are no electric or telephone utilities near the Willow Creek site. However, the area is within the service area of Pacific Power and Light, Hermiston, Oregon and Telephone Utilities, Inc., Lebanon, Oregon. Both companies are willing to supply service for the cost of extending their lines. (Refer to correspondence in Appendix A.) Solid waste would likely be disposed of by incineration and/or burial on-site, or it could be hauled to the Arlington municipal landfill.

## H. Cultural Resources

There are no known archaeological sites in the project vicinity. However, a detailed archeological investigation prior to construction is recommended (refer to the Cultural Resource Overview report in the Summary Report).

# III THREE MILE CANYON SITE INFORMATION

## A. Location

The Three Mile Canyon site is between the Columbia River and the Union Pacific/Interstate 84 transportation corridor. It is in Section 19, Township 4 North, Range 23 East, in Morrow County, Oregon, approximately 3 miles east of Willow Creek. Figure 1 is a Location Map and Figure 3 is a Vicinity Map for Three Mile Canyon.

## B. Land Ownership

All land in the project area is owned by the Federal Government.

## C. Site Description

This is a recreational area accessible from the Three Mile Canyon interchange on Interstate 84. The area is undeveloped and the only improvement is a small boat launching ramp. The land is relatively flat with sparse, low vegetation. The adjacent river has a protected bay formed by an island and narrow peninsula from the shore. Water depths vary from 6 to 30 feet and, from observations made from a small boat on April 24, 1987, there appears to be negligible water circulation.

D. Access and Services

Access to this site is quite good. There is a road from the Three Mile Canyon off-ramp directly to potential building areas. The nearest services are in Arlington, Oregon, approximately 20 miles west.

E. Soils and Vegetation

The USDA Soil Conservation Service classifies this soil as the Quinton-Rock Outcrop complex. The complex is about 60 percent Quinton soil, 20 percent rock outcrop, and 20 percent Koehler and Quincy soils and dune land. Quinton soil has a dark brown loamy fine sand surface layer about 30 inches thick over 7 inches of dark brown gravelly loamy fine sand. Fractural basalt bedrock is reported at a depth of about 37 inches. The soil is very permeable; erosion potential is low but the hazard of soil blowing is high.

Vegetation consists of grasses and shrubs. There are no trees.

F. Flood Levels

The John Day Pool elevations at Three Mile Canyon are essentially identical to those at Willow Creek. There is no major drainage entering the Columbia at Three Mile Canyon.

## G. Utilities

Services for power, telephone, and solid waste disposal are the same as Willow Creek.

## H. Cultural Resources

There are no known archaeological sites at Three Mile Canyon. However, a detailed archaeological investigation prior to construction is recommended (refer to the Cultural Resources Overview report in the Summary Report).

# IV PRODUCTION GOALS

Willow Creek and the alternative Three Mile Canyon site were evaluated to determine their ability to provide acclimation and imprinting for 30,000 pounds of fry in four 7,500 pound lots. Upon arrival, the fish would be either fry at approximately 100 per pound or smolt at 20 per pound. Three different acclimation periods from 3 to 21 days plus one zero day "acclimation period" are planned. The fish will be fed a standard hatchery diet and generally will be cultured consistent with currently accepted practices for chinook salmon in Oregon and Washington. Fish culture standards and engineering criteria used for this work are based on the U.S. Fish & Wildlife's Fish Hatchery Management publication and other accepted authorities. Pertinent criteria with references are included in the Summary Report.

# V DEVELOPMENT CONCEPTS

## A. Willow Creek

The Willow Creek area was evaluated for both land based and floating fish rearing facilities. The only suitable land based site is an area on the west shore about 1,500 feet south of the Interstate 84 east bound lanes. It has an average 10 percent slope towards the water. A building area could be developed at an elevation of approximately 375 feet, which is 10 feet above the normal water level. Access would be on a new 1.2 mile long gravel surfaced road from Oregon State Highway 74. It would cross the Union Pacific Heppner Branch tracks just west of the site.

A water based site for net pens could be developed near the Interstate and Union Pacific bridges where the current is strongest. However, the shore based support facilities would have to be located in the same area as described above. Early in the study a site on the west shore between the highway and railroad bridges was identified. This would have been much closer to the net pens, but was on Interstate right-of-way with access across Union Pacific property. The Oregon Department of Transportation and Union Pacific were contacted to request permission for access. The Oregon DOT felt this proposal was incompatible with highway use.

Site Plans which show each concept are in Figures 3-6. Detail drawings of the proposed concrete raceways, asphalt lined ponds, and floating net pens are in the Summary Report.

There are two major problems with the Willow Creek sites, both caused by the irrigation pump station. From March 15 until November 1 each year, the station pumps large quantities of water. This creates a current into the backwater that is opposite in direction from true downstream flow. The result very likely would be that fry released from the facility would swim to the pump station instead of down river. Also, since the pump station takes flow from the Columbia and Willow Creek, and any flow from the fry rearing facility, there would be no attraction water for returning adults. A solution would be to haul fry to a downriver release site or to stop pumping during periods of fry release and adult returns.

1. <u>Shore Based Facility</u>

The shore based site described above would be suitable for permanent concrete raceways, temporary vinyl raceways, or lined ponds. A mobile home for an office and facility manager residence, a fish food freezer, and an emergency generator would be located on site. If the attraction water problem could be solved, returning adults would enter a fish ladder from the Willow Creek backwater, swim to a sorting area, and then move to the ponds or raceways for holding prior to spawning. The entire site, except at the fish ladder, would be enclosed by a 12 foot high chain link fence. A gate on the access road at Highway 74 would provide additional security.

2. Water Supply

The required 15 cfs water would be supplied by both pumped river water and a ground water well. Based on the Report of Ground Water Resource Evaluation . . . in Appendix C, it appears there is good potential for a deep but high yield well. It may even be possible to develop a well that flows under artesian pressure HOwever, until more investigation is done, pumping is assumed. The pupi ng head from a well could be 700 to 1,000 feet and there fore, it would Se uneconomical to use ground water fosr the entire supply. Instead, a small amount of ground water would be used for imprinting and the remainder- would be river water, which has less expensive pumping requirements. Ground water from a deep well also is likely to be warmer than desired. The temperature may be as high as 68 degrees F at 600 to 700 foot depths and 75 to 82 degrees F at 1.000 foot depths This warm ground water could be tempered by mixing with coller river water. Two cfs of 68 degree F well water mixed with 13 cfs of 55 degree F river water would produce a 56.7 degree F blend.

A 1 to 2 cfs well would probably have an 8 inch perforated casing in the producing zone. For 1,000 feet of pumping head, 160 to 320 horsepower would be required. The discharge piping would be 8 to 10 inches and the well probably could be located very close to the ponds or raceways.

A river water pump station for 13 to 14 cfs could be constructed within 300 feet of the raceway or pond manifolds. It would be constructed in the water on driven steel pipe piles that support a reinforced concrete slab. Three 20 horsepower vertical turbine pumps, each capable of pumping 6 cfs, would extend through the slab into the water. Screens would be provided to maintain a maximum 0.5 foot per second intake velocity. The actual motor size would depend on final design elevations. The pumps could run singly or simultaneously, depending upon flow needs at a particular time. Controls would have an alternator to cycle lead/lag functions and equalize pump wear. Each pump would manifold into a 24 inch discharge pipe. Check, pump control, and pressure relief valves would be included. Conceptual design drawings for a river water pump station are in the Summary Report.

Discharge piping from the well and river water pump station would manifold together and have valves for mixing and flow rate control.

3. Water Based Facility

Water based rearing could be done in the areas between the highway and railroad bridges. Current flow to the pump station is relatively strong (on the order of one foot per second) and, therefore, net pens are considered the most appropriate. To meet the desired production, 6 pens (each roughly 12 by 12 by 6 meter deep) will be required. One array of three pens would be moored between the railroad and the west bound lanes of Interstate 84. Another array of three pens would be between the east and west bound lanes. The moorage system would consist of lines and anchors to the shore and to the bottom.

For stocking the pens would be moved to just off the shore based site and fry placed in the pens from the tank truck with a floating pipeline. After a pen is full it would be towed to its permanent position and connected to the mooring system.

Food would be moved from the shore based preparation building to the pens by skiff. The skiff could have a food blower or sacks of feed could be taken to the pens for distribution from automatic feeders or a blower that operates from the pen walkways.

The shore based facilities would include an office/residence mobile home, a fish food freezer and preparation building, an emergency generator, and a boat dock and launching ramp. These would be enclosed by a 12 foot chain link fence. The access road would be the same as described previously.

Adult capture and spawning could be done with a trap and pens constructed in the water from the east bound lanes embankment at the bridge. This would consist of a fish fence that leads adults to a V trap and sorting and holding pens. The fence and pens would be constructed of steel piles driven into the bottom. Perforated horizontal steel beams would span between piles. Pipe pickets at 2 to 3 inches on center would fit into the perforations to form the enclosure. The floor of the pens would be a steel grate moveable vertically to make the pens shallow for spawning or deep for holding. Conceptual level details are shown in Figure 7. Again, as with the shore based adult capture, this concept will work only if the attraction water problem can be solved.

4. <u>Water Quality and Temperature</u>

On April 24, 1987, samples of river water were obtained from between the railroad and highway bridges at an approximate depth of 6 feet. These samples were taken to AM Test, Inc., Redmond, Washington for analysis. Complete results are in

Appendix D. Both copper and zinc concentrations were found to be higher than normally accepted levels. On April 24, 1987, the river water temperature at 6 feet deep was 53 degrees F.

No data exist for ground water quality in the Willow Creek area.

B. Three Mile Canyon

The Three Mile Canyon site was also evaluated for land based and floating fish rearing facilities. Generally, this site is much superior to Willow Creek. There is existing access and special permission from the Oregon Department of Transportation and Union Pacific is not necessary. This site also does not have the problem with out-migration or adult attraction water that Willow Creek has. A secondary benefit is that the potential building site is much flatter. It would be at an approximate elevation of 270 feet, 5 feet above the normal river level.

An adjacent protected water area is available for floating pens. However, since there is no river current through this area, floating pens would require a pumped water supply.

Site Plans which show each concept are in Figures 8-10.

1. <u>Shore Based Facility</u>

The Three Mile Canyon shore based site would be suitable for permanent concrete raceways, temporary vinyl raceways, or lined ponds. Although the configuration would be slightly different, it would have the same office/residence, fish food freezer/preparation building, emergency generator, adult capture/spawning, and security fence as at Willow Creek.

2. <u>Water Based Facility</u>

A net pen concept is probably not viable at this location because there is no water flow to bring in oxygen and remove metabolic wastes. However, floating pens with solid vinyl or rubber sides, a net bottom, and a pumped water supply could be used.

Criteria for land based raceways or ponds indicate allowable loading densities of 1.5 pounds per cubic foot (pcf). Net pens, with only river or tidal current for water supply, have typical loading densities from 0.2 to 0.4 pcf. Criteria for floating raceways, such as proposed here, are not available. Considering an adequate water supply, but less than optimum flow patterns, a density of 0.8 pcf seems reasonable and is used to estimate the required volumes. The initial 30,000 pounds of fry will weigh nearly 45,000 pounds upon release.

At 0.8 pcf this requires 56,250 cubic feet of volume, or 3 pens each 12 by 12 by 4 meters deep. The flow volume would be 15 cfs to give an exchange rate of roughly one per hour.

The floating pens would be moored with lines and anchors to the bottom. Water, pumped from a well and the river, would be delivered in a submerged polyethylene pipeline. Each pond would have a valved manifold for uniform flow distribution. The raceways would be supported by foam and polyethylene floats with a steel grate walkway above. Loading fry into the raceways and feeding would be very similar to that proposed at Willow Creek.

An adult capture and spawning facility for this concept would be constructed on shore. Holding pond and attraction water would be from the same well and river water pump station. Adults would enter a fish ladder that extends into the river, swim into a sorting pond, and then proceed into lined ponds for holding prior to spawning. Refer to the floating raceway Site Plan in Figure 10.

3. Water Supply

The 15 cfs required for either the shore or water based facility would come from a 1 to 2 cfs ground water well plus a

13 to 14 cfs river water pump station. These supply works are identical to those proposed for Willow Creek (refer to Section V.A.2. for details).

4. Water Quality and Temperature

On April 24, 1987, river water was sampled from the Three Mile canyon area proposed for floating raceways at an approximate 6 foot depth. The samples were analyzed by AM Test, Inc. and results are in Appendix 0. Ammonia, copper, and zinc concentrations exceed the recommended maximum limitsThe temperature 6 feet deep on April 24, 1987 was 54 degrees F.

# VI COST SUMMARIES

Two alternative concepts, consisting of land based facilities with either concrete or vinyl raceways or floating pens, are proposed at the Willow Creek and Three Mile Canyon sites. Construction cost summaries, exclusive of land acquisition or professional services fees, for Willow Creek are in Table 1 and for Three Mile Canyon are in Table 2.

· TABLE 1 ·

WILLOW CREEK COST SUMMARY

| | Concrete Raceways | Asphalt Ponds | Membrane Ponds | Vinyl Raceways | Floating Net Pens |
|---|---|---|---|---|---|
| Site Work | $ 193,700 | $228,700 | $228,700 | $ 193,700 | $ 91,400 |
| Ponds, Raceways, or Net Pens | 247,000 | 93,200 | 79,700 | 205,700 | |
| Extra for Adult Capture | - | 21,000 | 21,000 | | 240,600 |
| River Water Pump Station | 172,700 | 172,700 | 172,700 | 172,700 | |
| Ground Water Well | 132,200 | 132,200 | 132,200 | 132,200 | |
| Office/Housing | 12,500 | 12,500 | 12,500 | 12,500 | 12,500 |
| Food Freezer/Prep. Bldg.* | 48,900 | 48,900 | 48,900 | 48,900 | 48,900 |
| Standby Generator | 68,000 | 68,000 | 68,000 | 68,000 | 3,000 |
| Motor Starter, Switch Gear | 35,700 | 35,700 | 35,700 | 35,700 | |
| Electric Utility | 44,000 | 44,000 | 44,000 | 44,000 | 44,000 |
| Telephone Utility | 8,500 | 8,500 | 8,500 | 8,500 | 8,500 |
| Subtotal | 963,200 | 865,400 | 851,900 | 921,900 | 448,900 |
| 15% Contingencies | 144,500 | 129,800 | 127,800 | 138,300 | 67,300 |
| Total | $1,107,700 | $995,200 | $979,700 | $1,060,200 | $516,200 |
| Monthly Power Cost | 11,880 | 11,880 | 11,880 | 11,880 | 308 |

* Portable Freezer Van Alternative Cost = $41,500

## · TABLE 2 ·

### THREE MILE CANYON COST SUMMARY

| | Concrete Raceways | Asphalt Ponds | Membrane Ponds | Vinyl Raceways | Floating Raceways |
|---|---|---|---|---|---|
| Site Preparation | $ 67,700 | $ 97,700 | $ 97,700 | $ 67,700 | $133,800 |
| Ponds, Raceways, or Net Pens | 247,000 | 93,200 | 79,700 | 205,700 | 65,800 |
| Extra for Adult Capture | - | 21,000 | 21,000 | 54,100 | 21,000 |
| River Water Pump Station | 172,700 | 172,700 | 172,700 | 172,700 | 172,700 |
| Ground Water Well | 132,200 | 132,200 | 132,200 | 132,200 | 132,200 |
| Office/Housing | 12,500 | 12,500 | 12,500 | 12,500 | 12,500 |
| Food Freezer/Prep. Bldg.* | 48,900 | 48,900 | 48,900 | 48,900 | 48,900 |
| Standby Generator | 68,000 | 68,000 | 68,000 | 68,000 | 68,000 |
| Motor Starter, Switch Gear | 35,700 | 35,700 | 35,700 | 35,700 | 35,700 |
| Electric Utility | 110,000 | 110,000 | 110,000 | 110,000 | 110,000 |
| Telephone Utility | 10,500 | 10,500 | 10,500 | 10,500 | 10,500 |
| Subtotal | 905,200 | 802,400 | 788,900 | 918,000 | 811,100 |
| 15% Contingencies | 135,800 | 120,400 | 118,300 | 137,700 | 121,700 |
| Total | $1,041,000 | $922,800 | $907,200 | $1,055,700 | $932,800 |
| Monthly Power Cost | 11,880 | 11,880 | 11,880 | 11,880 | 308 |

* Portable Freezer Van Alternative Cost = $41,500

# VII ADVANTAGES AND DISADVANTAGES

## A. Willow Creek

The land based site at Willow Creek has the following advantages and disadvantages:

- All water is pumped.
- Site access requires Oregon DOT and Union Pacific Railroad approval.
- The site is moderately steep.
- The irrigation pumping station causes currents in the wrong direction.
- Good access control for security.

  River water has excess levels of ammonia, zinc, and copper.
- Land ownership is favorable.

  There are no identified cultural resources.

The net pen site at Willow Creek has the following advantages and disadvantages:

Adequate river current for oxygen delivery/waste removal.

Land based support site far away.

All pen access by boat.

Expensive and unproven design for adult capture, holding, and spawning.

Both sites have potential fish health problems.

B. The land and water based sites at Three Mile Canyon have the following advantages and disadvantages:

Easy access from Interstate 84.

All water is pumped.

Site security more difficult.

River water has excess levels of ammonia, zinc, and copper.

Favorable land ownership.

Potential fish health problems.

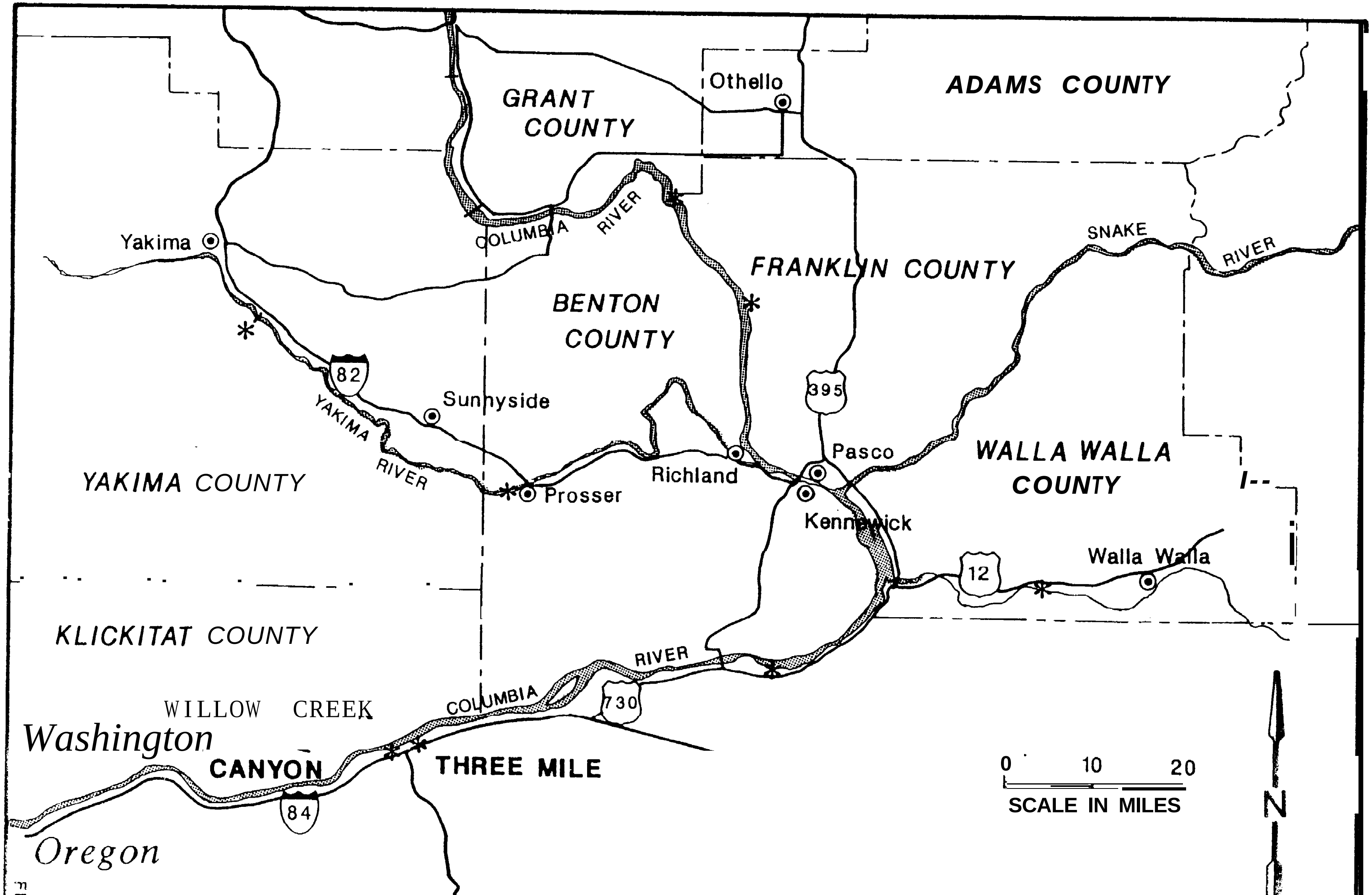
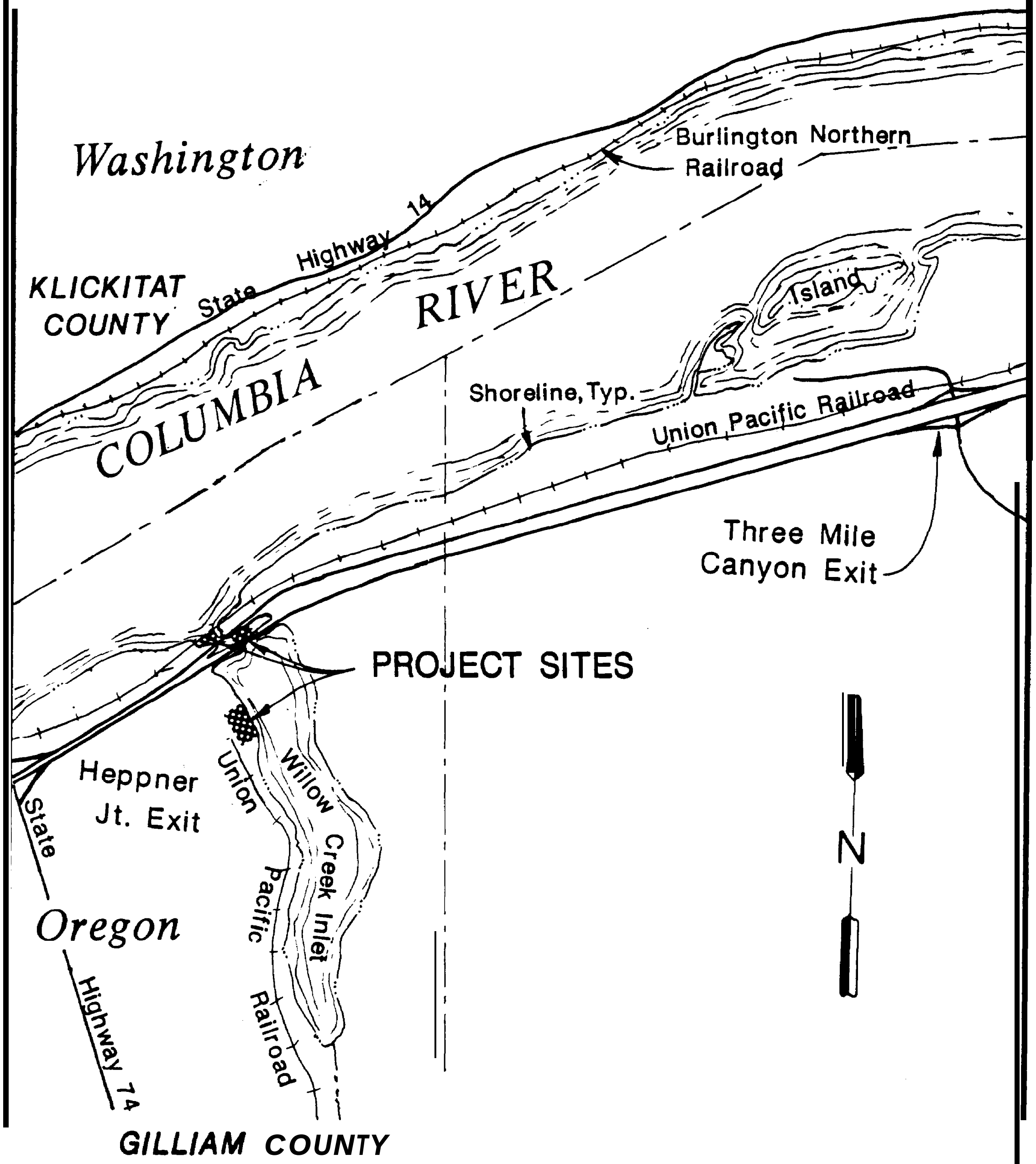



FIGURE 1

**LOCATION! MAP**

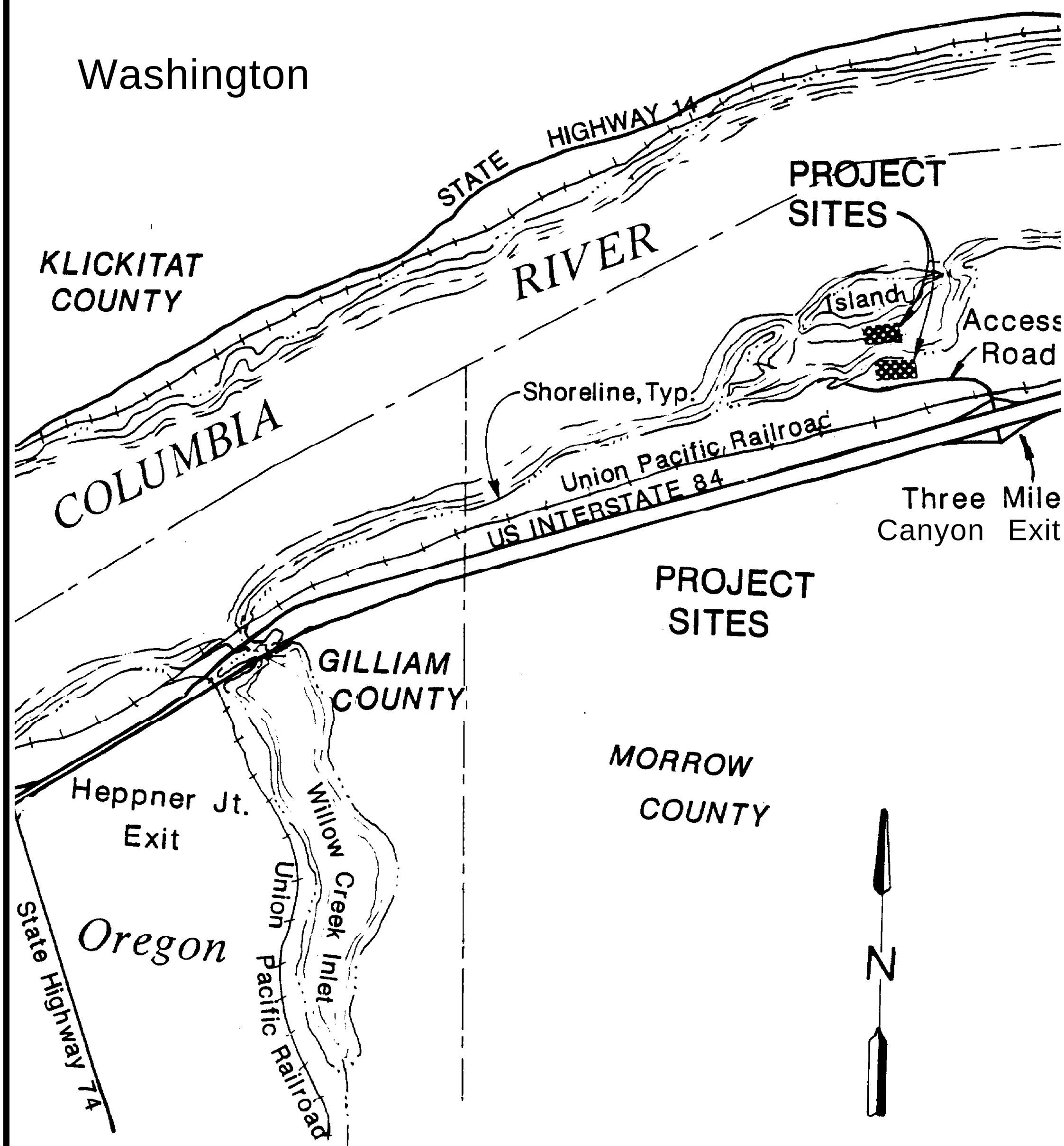



**VICINITY MAP**

**WILLOW CREEK**

SCALE: 1"=4000'

FIGURE 2

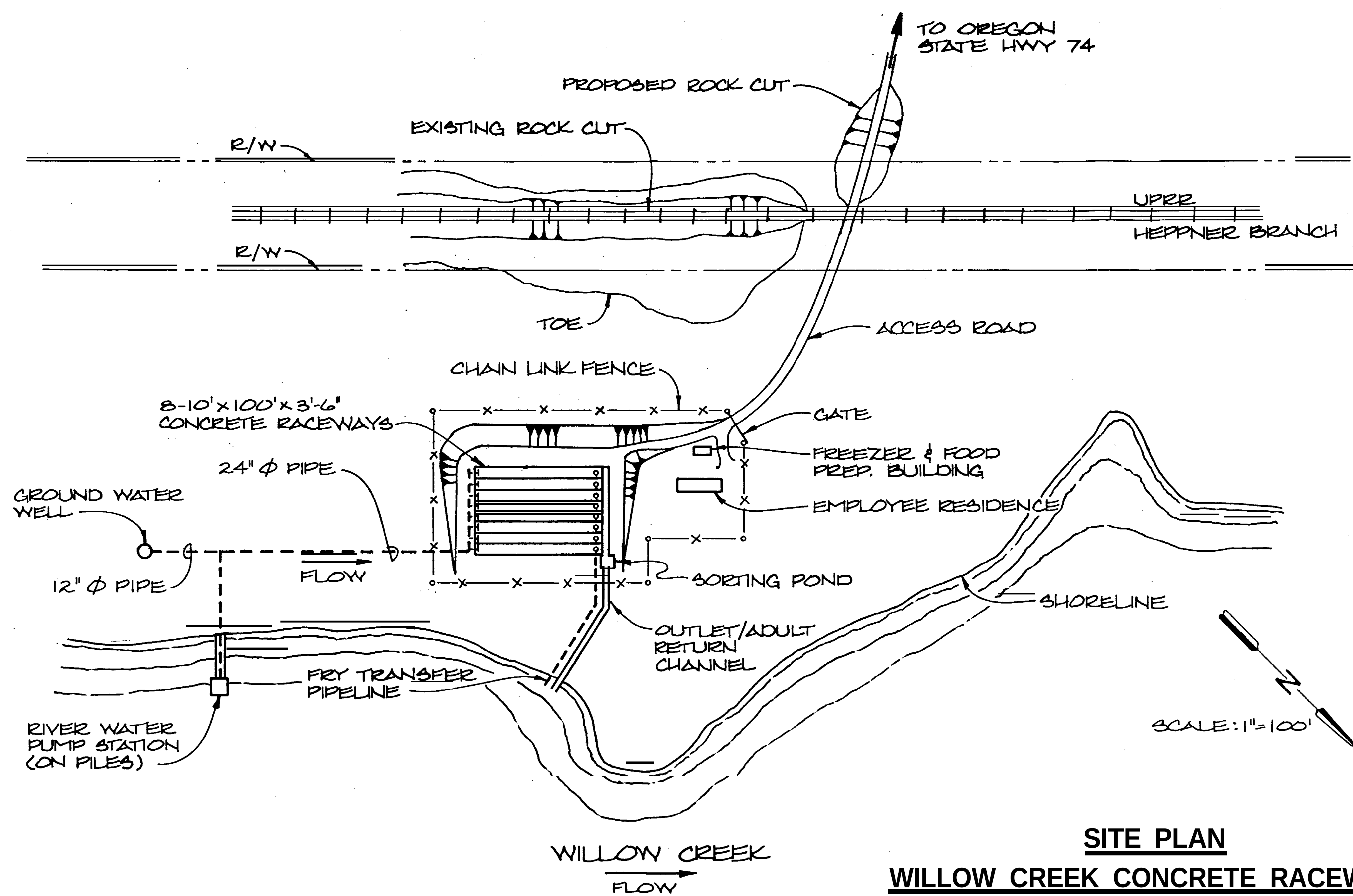



**VICINITY MAP**

**THREE MILE CANYON**

SCALE: 1"=4000'

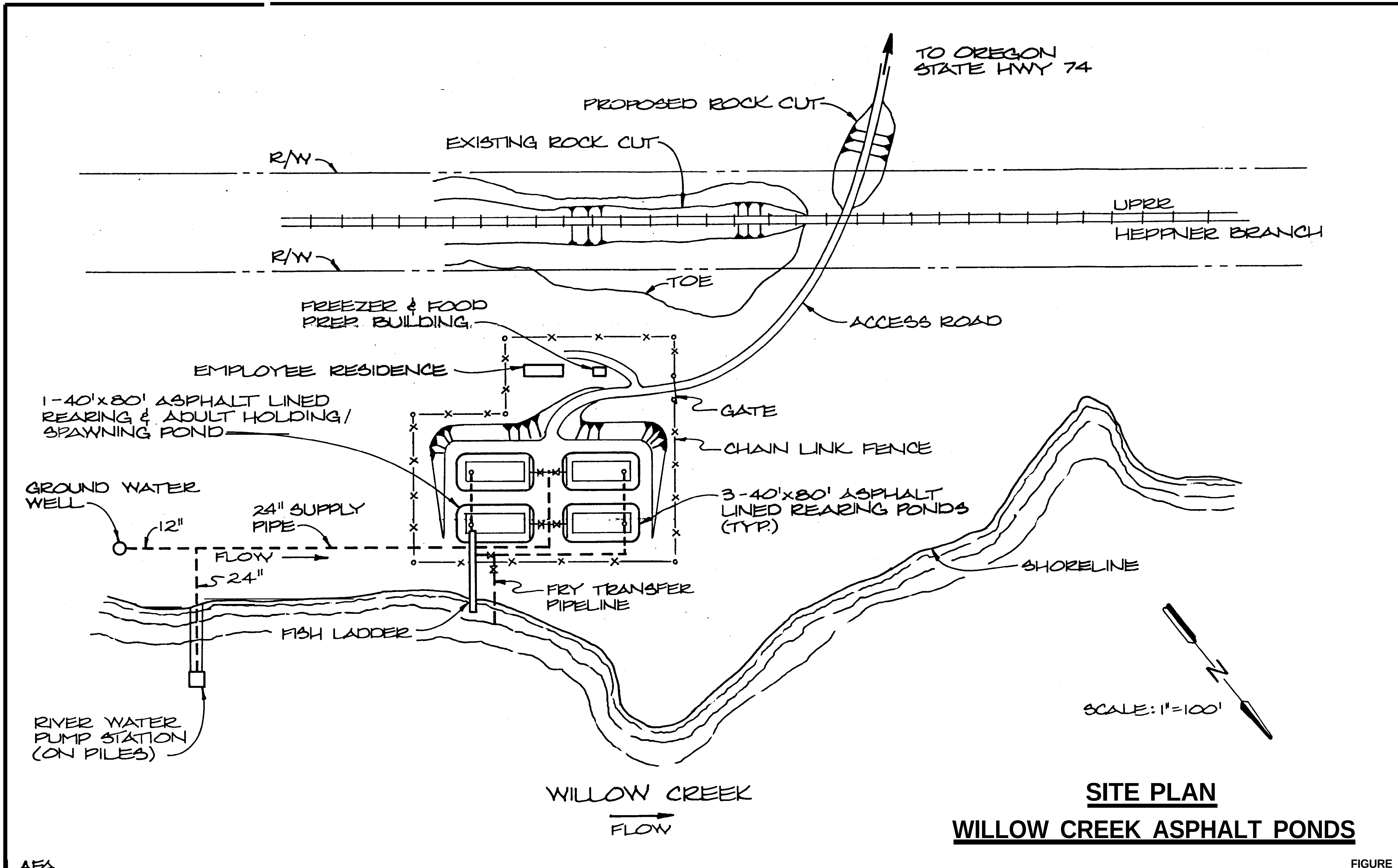
FIGURE 3




**SITE PLAN**

**WILLOW CREEK CONCRETE RACEWAYS**

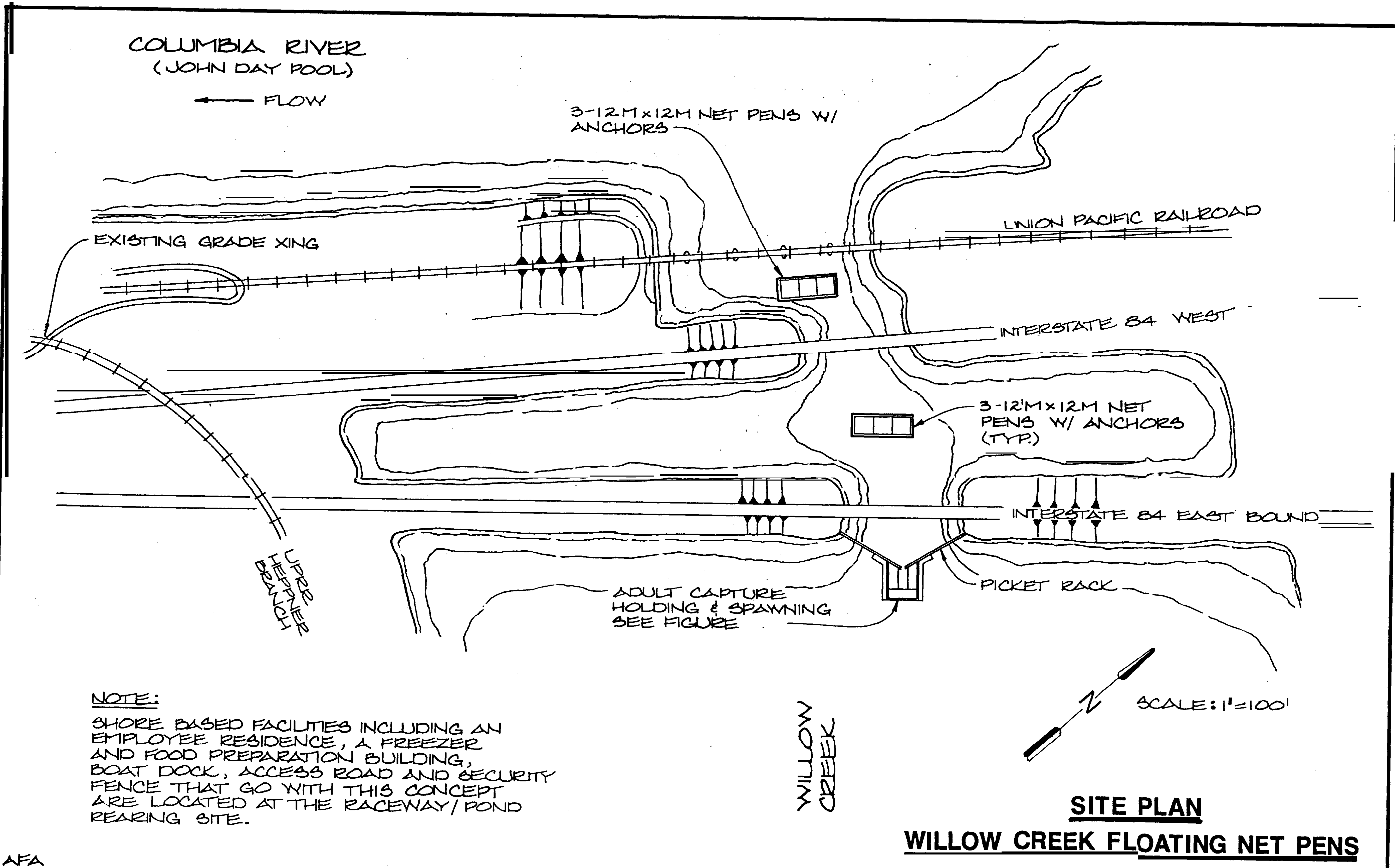
FIGURE 4




**SITE PLAN**

**WILLOW CREEK ASPHALT PONDS**

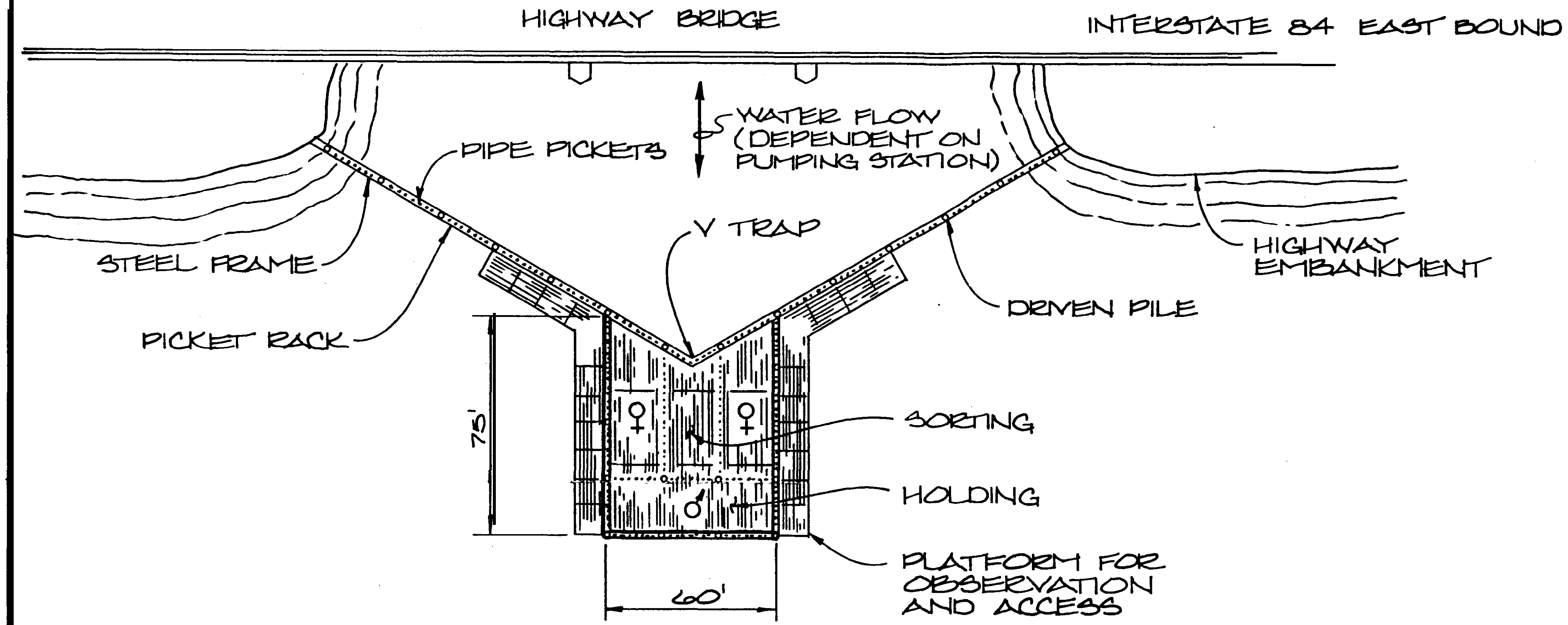
FIGURE 5



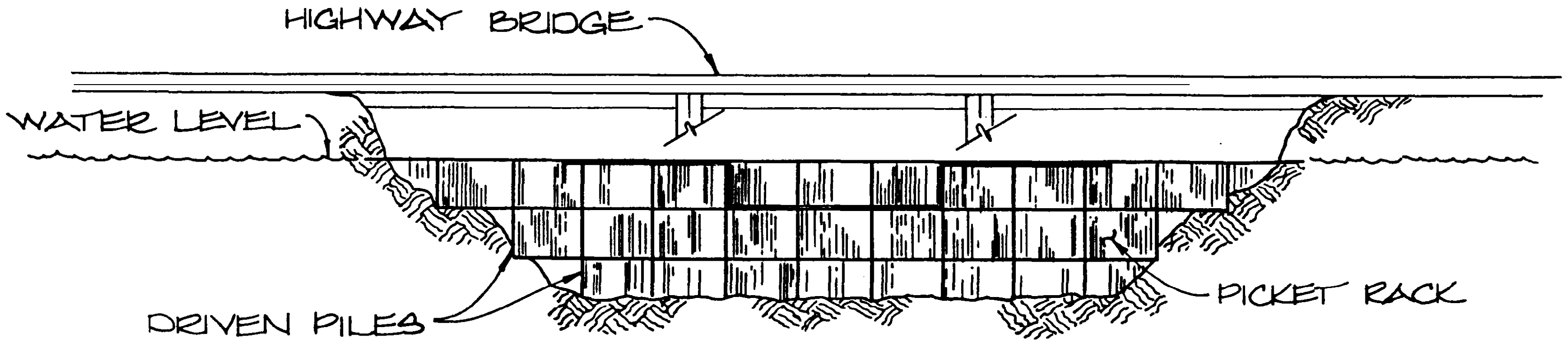

**SITE PLAN**

**WILLOW CREEK FLOATING NET PENS**

FIGURE 6




**PLAN**
SCALE: 1" = 50'



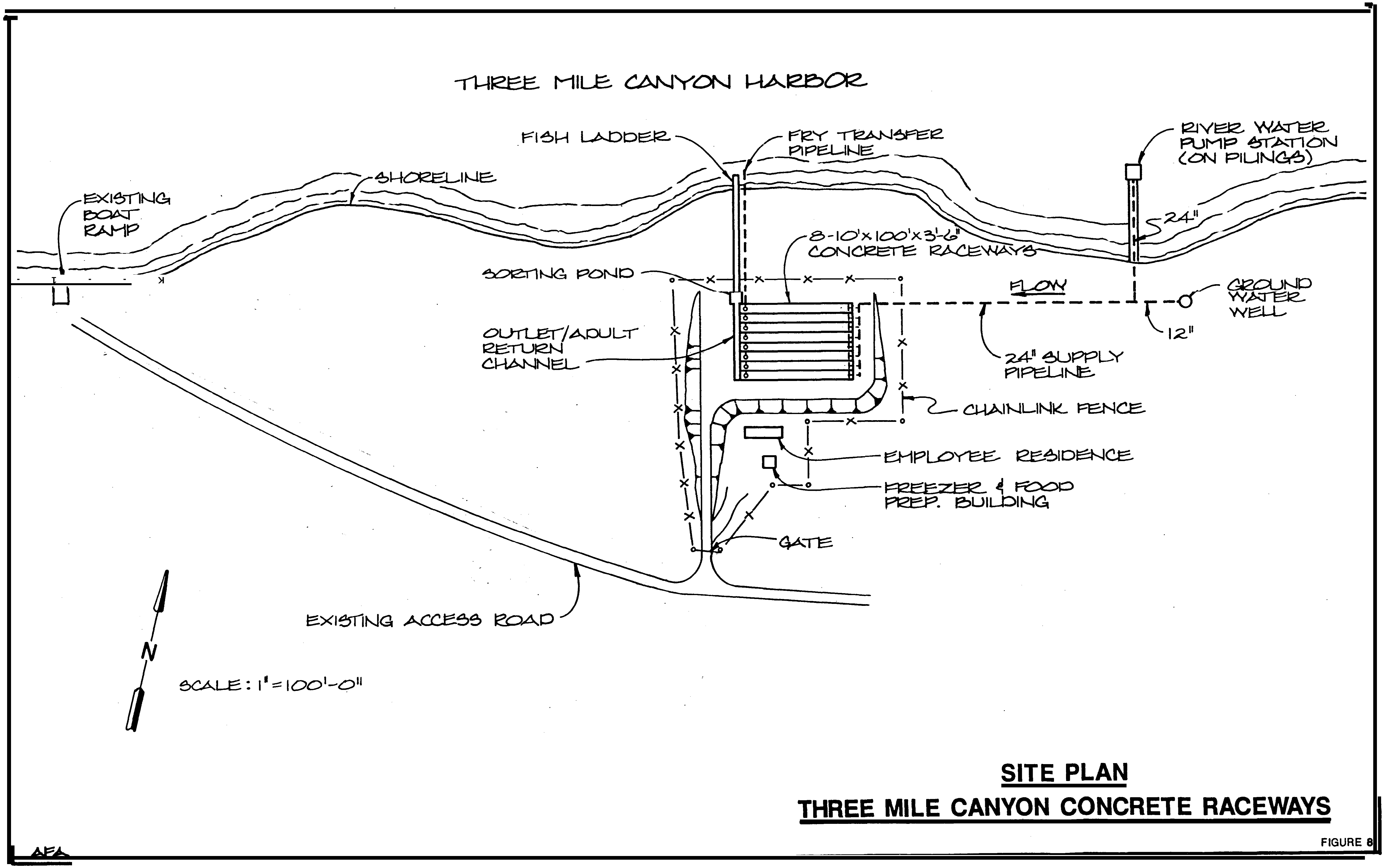

**ELEVATION**
SCALE: 1" = 50'

1. PICKET RACK GOES TO BOTTOM OF POND.
2. V TRAP FORCES ADULTS TO PASS INTO SORTING IN THE FIRST 6 FEET OF WATER DEPTH.
3. SORTING/HOLDING IS 6 FEET DEEP AND CAN BE MADE SHALLOW BY RAISING THE STEEL GRATE BOTTOM. INTERIOR PICKETS CAN BE REMOVED FOR WORKER ACCESS.

**DETAILS**
**ADULT CAPTURE/HOLDING PENS**
**WILLOW CREEK NET PEN REARING**

AFA

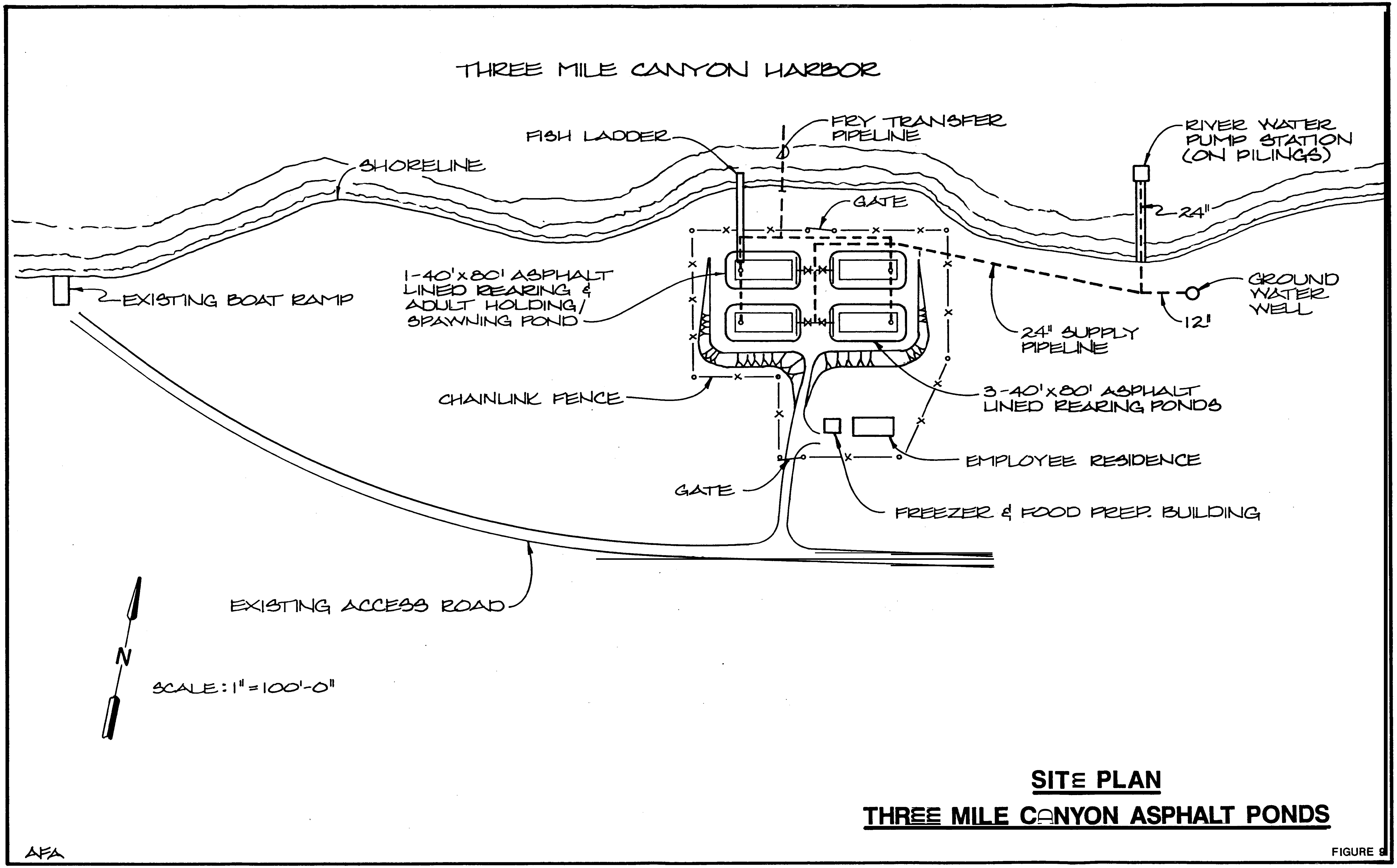
FIGURE 7




**SITE PLAN**

**THREE MILE CANYON CONCRETE RACEWAYS**

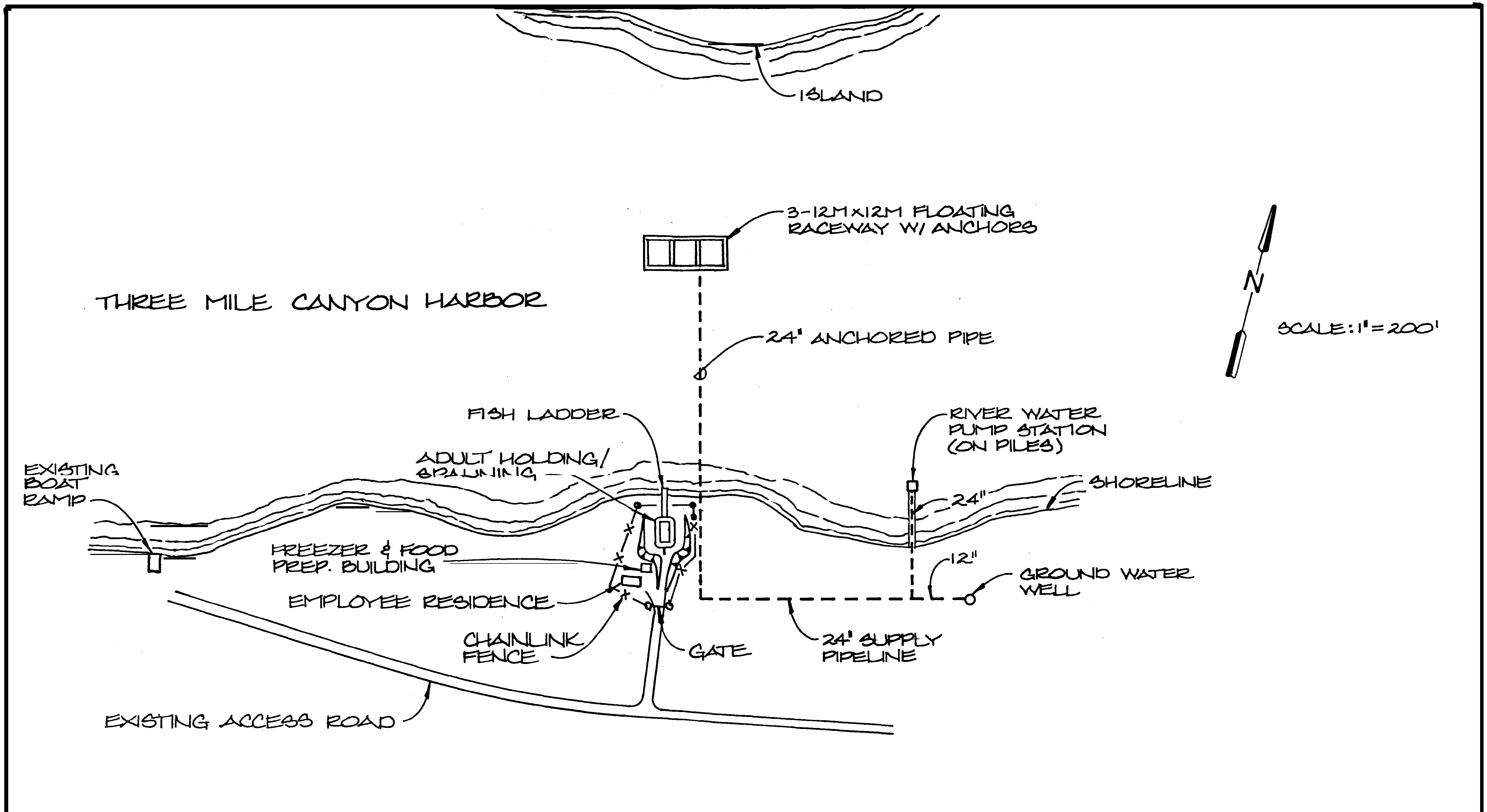
FIGURE 8




**SITE PLAN**

**THREE MILE CANYON ASPHALT PONDS**

FIGURE 9




**SITE PLAN**

**THREE MILE CANYON FLOATING RACEWAYS**

FIGURE 10

# APPENDIX A

# CORRESPONDENCE

Sverdrup
CORPORATION
[illegible] 112th Avenue N.E.
Suite C [illegible]
P.O. Box 369
Bellevue, Washington 98009
206 454-9562

May 13, 1987

Telephone Utilities, Inc.
P.O. Box 337
Lebanon, Oregon 97355

Attention: Mr. Bob Campbell

Gentlemen:

Subject: Telephone Service
Willow Creek, 3 Mile Canyon

This is to inquire about residential telephone availability and cost at two locations within your service area. The sites are at Willow Creek in Gilliam County and 3 Mile Canyon in Morrow County. Their general location is indicated on the enclosed maps. The specific residence locations are shown on the Site Plan sketches also enclosed. Please note that at Willow Creek we are considering two alternate sites for the residence.

We need this information for a chinook salmon fry rearing feasibility study being done for the U.S. Fish and Wildlife Service. The plan is to raise fish from Spring Creek Hatchery for up to one month prior to release into the Columbia River. They should imprint and return to these sites as adults.

At your earliest convenience, please send me a letter that gives an approximate cost for providing this telephone service. Also, let me know if there are unusual rates, etc. because of the remote locations.

Please let me know if you have questions and thanks for your assistance.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosures

PACIFIC
TELECOM

Telephone Utilities
of Eastern Oregon, Inc.
P.O. Box 337
Lebanon, Oregon
97355

Telephone
503.259-1241

July 8, 1987

Sverdrup Corporation
1200 112th Avenue, N.E.
Suite c-143
P.O. Box 369
Bellevue, Washington 98009

ATTN: Glen Aurdahl:

Gentlemen:

I have field reviewed the three chinook salmon fry rearing sites as you requested. It is our determination that for an estimated construction cost of $10,500, we could provide residential telephone service to the three mile canyon site. This cost does not include the acquisition of easements or permits since Sverdrup Corporation will acquire all necessary easements and permits.

The Willow Creek net pen rearing site would require us to parallel Union Pacific Railroad properties to provide service to the residential location and, without an approved access road from UPRR, we cannot consider this route.

The Willow Creek pond rearing site would be impossible to bury telephone cable to because of the large amount of rock. Since Telephone Utilities of Eastern Oregon, Inc. does not want to build and maintain a new pole line, we would need to know how you propose to provide power to this facility so we can estimate a cost of providing telephone service by attaching our aerial cable to the existing power company poles.

If you have any questions regarding this matter, please call me at: (503) 259-7219.

by phone ~ $2500 for overhead on power co. poles.

Sincerely,

Bob Campbell

Bob Campbell
OSP Field Engineer

cc: Richard Johnson

RC:vf

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C-143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 13, 1987

Pacific Power and Light
P.O. Box 1150
Hermiston, Oregon 97838

Attention: Mr. Wayne Richards

Gentlemen:

Subject: Power Service
Willow Creek, 3 Mile Canyon

This is to inquire about the availability and cost of electric power at two locations within your service area. The sites are at Willow Creek in Gilliam County and 3 Mile Canyon in Morrow County. Their general location is shown on the enclosed maps and Site Plan sketches. At Willow Creek, please note that we are considering two alternate sites.

We are making this inquiry as part of a chinook salmon fry rearing feasibility study being done for the U.S. Fish and Wildlife Service. The needs are for up to 50 horsepower for pumping, approximately 3 horsepower for a fish food freezer, and probably a 200 amp service for a residence and low level outdoor lighting. The Willow Creek site, between westbound Interstate 84 and the Union Pacific Railroad, will not require pumps. However, because of its location, we suspect the power lines will have to be underground. These facilities will only operate during May and for six to eight weeks during October and November.

At your earliest convenience, please send me a letter that gives an approximate cost for providing this electric service. Also please include your power rates so that we can estimate operational costs.

Please let me know if you have questions, and thank you for your assistance

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosures

PACIFIC POWER 705 S First Street . P O Box 1150 ' Hermiston Oregon 97838 . (5031567-8331

May 21, 1987

RECEIVED
MAY 27 1987
SVERDRUP CORP
SEATTLE OFFICE

Sverdrup Corporation
1200 112th Ave. N.E.
Suite C 143
P O Box 369
Bellevue, Wa. 98009

Subject: Power Service to Willow Creek and Three Mile Canyon.

This is to acknowledge your request involving the above project. I had to make some assumptions, in estimating costs, at these locations. They will be listed with each location and cost listed below. Dollars quoted for these sites are ballpark, and must be confirmed from your final job plans.

(1). The tree mile canyon site includes three (3) miles of overhead 3 phase line, and one (1) mile of underground 3 phase primary, Cost for this service is $110,000.00.
(2). The Willow Cove entrance site includes 6500' of overhead 1 phase primary, and 2000' of underground primary. cost for this service is $32,000.00.
(3). The West shore site at Willow Cove includes 8025' of overhead 3 phase primary. Cost for this service is $44,000.00.

Assumptions that were used and customer responsibilities are as follows:

1. Customer will do all trenching for underground.
2. Customer will provide schedule 40 conduit for underground where directed by Pacific.
3. Customer will construct concrete pad for underground transformer as directed by Pacific.
4. Pacific has not verified right of way with any land owners. Right of way must be provided by customer.
5. There is a possibility that overhead lines may not be allowed in some areas.
6. Permits must be obtained from Oregon State Highway Department and Union Pacific Railroad. Allow six (6) months.
7. Three phase services do not have provisions for single phase. We only figured one (1) metering point at each location.
8. In inaccessable locations such as the mouth of Willow Cove, the customer will have to provide an access road for construction purposes.

Sincerly,

Wayne Richards

441

Wayne Richards
Estimator - Hermiston

WR/p

Sverdrup
CORPORATION

1200 112th Avenue. N E.
Suite C 143
PO Box 369
Bellevue. Washmgton 98009

206 454-9562

file copy

April 30, 1987

Union Pacific Railroad
Western Region
406 West, 100 south
**Salt Lake City, Utah** 84101

Attention: Mr. E. C. May
General Manager

Gentlemen:

Subject: Heppner Junction Proposed
Grade Crossings

This is to respectfully request your comments regarding two proposals for chinook salmon fry rearing at Willow Creek near Heppner Junction, Oregon. one proposal is for shore based facilities and the other has net pens floating between the highway and railroad bridges. These are shown conceptually on the enclosed sketches prepared by Sverdrup for a feasibility study we are doing for the U.S. Fish and Wildlife Service.

One proposal includes an access road grade crossing of your Heppner Branch. This is shown on an air photo, a USGS quad map and the site plan sketch. The crossing would be just north of an existing rock cut on your branch line. The access road would require minor rock excavation on the west side of your tracks. Power, telephone and water to this site likely would be under your tracks in bored casings.

The second proposal uses an existing UPRR maintenance road that is parallel to the main tracks and which crosses the branch line. It also has a new access road, fencing and temporary (2 months per year) structures on railroad and Oregon DOT right-of-way. The structures include a mobile home for a fish culturist and a portable walk-in freezer for fish food storage. Utilities probably would be buried the entire right-of-way length.

**As** mentioned, the work we are doing is feasibility level only and therefore we are not requesting formal permission

Mr. E. C. May
Union Pacific Railroad
April 30, 1987 - 2

for either of these proposals. Rather, this is just an inquiry to obtain your general reaction. At your convenience, please review this information and let us know how you feel. Also, please phone if you have questions.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen

cc: Bill Striplin, USF&WS (w/encl.)
Harold Hansen, ODF&W (w/encl.)

UNION PACIFIC RAILROAD COMPANY

406 West 100 South
Salt Lake City, Utah 84101

June 15, 1987

RECEIVED
JUN 17 1987
SVERDRUP CORP.
SEATTLE OFFICE

Sverdrup Corporation
1200 - 112th Avenue, N. E.
Suite C 143
P. O. Box 369
Bellevue Washington 98009

ATTENTION: Mr. Glen Aurdahl

Gentlemen:

Reference is made to your letter dated April 30, 1987, concerning the Heppner Junction proposed grade crossings.

After reviewing this proposal, your second proposal mentioned in letter, appears to be the most feasible from the Railroad Company standpoint. However, as per the telephone conversation with Messrs. Anderson, Norm Sifer and Jack Preston, it was decided that we would need a more accurate detailed picture of where the proposed access road would be located.

Attached is a blue print of the Heppner Junction area (Scale: 1" - 100').

Please indicate the proposed road and facilities on this print and return same to this office.

E. C. May

E. C. May

Attach.

cc-Mr. R. J. Larkin, Supt.
Union Pacific RR Co.
Albina, Oregon

JEP/RF/0615C

Sverdrup
CORPORATION

1200 112th Avenue. NE.
Suite C 143
PO. Box 369
Bellevue, Wasnrnqon 98009

206 454-9562

June 24, 1987

Union Pacific Railroad Company
Western Region
406 West, 100 South
Salt Lake City, Utah 84101

Attention: Mr. E. C. May
General Manager

Gentlemen:

Subject: Heppner Junction
Proposed Grade Crossings

Thank you for your letter dated June 15, 1987, responding to the use of an access road over your property. As you requested, we have sketched the proposed salmon acclimation pond facility and road as it would appear if built at the net pen rearing site.

We are still interested in more specific comments about the land based alternative crossing shown on the map sent with a letter dated April 30, 1987. Enclosed is another map of this alternative and the 1"-100' scale map that you provided to us for additional information on the net pen rearing site.

As mentioned, the work we are doing is feasibility level only and therefore we are not requesting formal permission for either of these proposals. Rather, this is just an inquiry to obtain your general reaction. Please review this information and let us know how you feel. Also, please phone if you have any questions.

Very truly yours,

SVERDRUP CORPORATION

Glen M. Aurdahl

Glen M. Aurdahl, P.E.

CC: Bill Striplin, USF&WS
Harold Hansen, ODF&W

RECEIVED
JUL 24 1987
SVERDRUP CORP
SEATTLE OFFICE

**UNION PACIFIC RAILROAD COMPANY**

UNION PACIFIC

406 West 100 South
Salt Lake City, Utah 84101

July 21, 1987

9223: ORE: Heppner Jct.
Sverdrup Corp.

SVERDRUP Corporation
1200 - 112th Avenue, N.E.
P. O. Box 369 - Suite C 143
Bellevue, Washington 98009

ATTENTION: Mr. Glen Aurdahl

RE: Heppner Junction Proposed Grade Crossing

Gentlemen:

Please refer to your letter dated June 24, 1987, and all other correspondence concerning the proposed grade crossings for your operation at Willow Creek.

Union Pacific Railroad Company has no objections to your proposal, as outlined on the blue print of Heppner Junction which we sent to you on June 15, 1987.

When, or, if this project progresses past the feasibility stage, formal application must be made for a Crossing Agreement. For more information regarding the Crossing Agreement or right-of-way encroachment, please contact Mr. J. T. Hill, of our Portland Office at 503-249-2592.

Sincerely yours,

E C May

E. C. May

JEP/RF/09721B

Sverdrup
CORPORATION

1200 112th Avenue N.E.
Suite C 143
PO Box 369
Bellevue Washington 98009

206 454-9562

May 1, 1987

Oregon Department of Transportation
Division of Highways
P.O. Box 850
LaGrande, Oregon 97850

Attention: Mr. Bob Hector
Region Engineer

Gentlemen:

Subject: Access from State 74 and
Interstate 84

This is to respectfully request your comments on two proposals for chinook salmon fry rearing at Willow Creek near Heppner Junction as they affect Oregon State Highway 74 and Interstate Highway 84. These proposals are part of a feasibility study Sverdrup is doing for the U.S. Fish and Wildlife Service.

The first proposal is for shore based facilities with access from Highway 74. We envision a dirt road with an alignment as shown on the enclosed USGS quad map. Use would be limited to 4 to 6 weeks each spring and 4 weeks each fall, and a gate in your fence could be installed if requested.

The second proposal is for floating pens between the two Interstate 84 bridges and the UPRR bridge. Site access would be from the existing UPRR maintenance road and a new access road parallel to the westbound lanes. Shore based improvements would include a security fence, a mobile home and a portable walk-in freezer (that would be on-site for only 8 to 10 weeks maximum each year), and a ramp and small boat dock. These are all shown on the enclosed site plan, air photo and quad sheet. Power, telephone and water to this location would be buried. Sewage disposal would be via an on-site septic tank and drain field. Additionally, there may also be an adult salmon capture, holding and spawning structure built from the eastbound lanes embankment. Please refer to the enclosed Adult Capture/Holding Pens sketch for details. Except for a few weeks in the fall, all pipe pickets would be removed to allow unrestricted Willow Creek flows.

As mentioned above, the work we are doing is feasibility level only and therefore we are not requesting formal permission for either of these proposals. Rather, this is just an inquiry to obtain your general reaction. At your convenience, please review this information and let me know how you feel. Also, please phone if you have questions.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen

cc: Bill Striplin, USF&WS (w/encl.)
Harold Hansen, ODF&W (w/encl.)

REC'D 5/12
HTA

NEIL GOLDSCHMIDT
GOVERNOR

# *Department of Transportation*

HIGHWAY DIVISION

**REGION 4**

**P.O. BOX 5309, BEND, OREGON 97708**

May 8, 1987

In Reply Refer to
File No.:

Harold T. Andersen
Sverdrup Corporation
PO Box 369
Bellevue, WA 98009

RE: Your letter Regarding Access from State 74 and Interstate 84

Your May 1 letter falls within the Bend Region and was referred to my office.

I have asked Chet Anderson, ph. 503-296-2215, The Dalles, to contact you and meet on the site.

Following this meeting, we will respond with both the Highway Division and Federal Highway likely reaction to the feasibility.

We appreciate your early contact with our agency.

Dale Allen

Dale D. Allen, P.E.
Region Engineer

RECEIVED
MAY 12 1987
... ...DRUP CORP.
...FFICE



734-t827 (I-87)

Sverdrup
CORPORATION

1200 112th Avenue, N E
Suite C 143
P O Box 369
Bellevue. Washington 98009

206 454-9562

-96-

May 22, 1987

Oregon Department of Transportation
Division of Highways
3313 N.E. Frontage Road
The Dalles, Oregon 97508

Attention: Mr. Chet Anderson

Gentlemen:

Subject: Willow Creek Access from
State 74 **and** Interstate 84

This is in reference to my May 1, 1987 letter to Mr. Bob Hector of your agency and your phone call to me yesterday.

The project we are working on is a feasibility study to evaluate temporary acclimation facilities as a mitigation measure for upriver bright fall chinook salmon damaged by construction of the John Day Dam. Funding is from the Bonneville Power Administration and project management is by the U.S. Fish and Wildlife Service (USF&WS). This program was developed jointly by the Columbia Basin Fish and Wildlife Council and the Columbia River Inter-Tribal Fish Commission, who coordinated with the Northwest Power Planning Council, the Washington Department of Fisheries, and the Oregon Department of Fish and Wildlife (ODF&W). Sverdrup is under contract with the USF&WS.

The feasibility study includes Willow Creek, 3 Mile Canyon and Hat Rock State Park, all on the Oregon side of the Columbia River. It also includes Ringold Springs and White Bluffs Ferry on the Columbia north of Pasco, Washington; Sunnyside, Prosser, Union Gap and Granger Side Channel on the Yakima River; and a site on the Walla Walla River near Lowden, Washington.

If a facility is built at Willow Creek it is planned to operate for fry rearing during May and possibly for capture and spawning of returning adults during October and November. It is my understanding that it will be operated jointly by the USF&WS and the ODF&W.

I trust this will satisfy your need for additional information. However, if it does not, please let me know.

I look forward to receiving your reply to my request for comments regarding access from Oregon Highway 74 and Interstate Highway 84.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

NEIL GOLDSCHMIDT
GOVERNOR

*Department of Transportation*
**HIGHWAY** DIVISION
**REGION 4**
PO. BOX 5309, BEND, OREGON 97708

June 22, 1987

RECEIVED
JUN 29 1987
SVERDRUP CORP.
SEATTLE **OFFICE**

In Reply Refer to
File No.:

Sverdrup Corporation
ATTN: Harold T. Andersen
PO Box 369
Bellevue, WA 98009

We have reviewed your initial proposal for a salmon capture and rearing facility at Willow Creek. Normally, interstate right-of-way is reserved for highway purposes. However, its use for the proposed facility could be allowed under an "Air Space Lease Agreement." This agreement would contain the conditions and terms under which the property could be used.

Compensation to the State for the necessary land would be at current market rates with the terms of the lease dependent upon the alternative selected by USF&WS and ODF&W.

In general, use of highway right-of-way for other than highway purposes needs to be justified. Your study of this site should demonstrate that the facility or use could not be accommodated outside of the right-ofway, and that in the public interest there is a compelling need to locate within the right-of-way. We would need sufficient information presented to ensure that the facility would not impair the motoring public's safe and efficient use of the highway, nor impair the operation, maintenance and ability to make future needed improvements to the highway.

We have some specific concerns on your proposed plan that should be considered in the feasibility study.

First, the fish rearing pens and the capture and holding pen, as proposed, could be considered. However, anchoring the pens to the I-84 bridges would not be allowed.

Second, the shore based support facility should not be located on highway right-of-way since other suitable land is available. Access to this facility from Route 74 will require a permit from the Division and should be located so as to provide for the safe use and operation of the highway.

Third, direct access from I-84 would not be permitted. This would include access during construction as well as for the continued operation and maintenance of the facility



734-1827 (I-87)

'I have enclosed for your use and review a copy of the right-of-way map of I-84 in the vicinity of Willow Creek structures with the right-of-way and access control line shaded green.

If you need additional information for your site investigation, feel free to contact Chet Anderson, District Maintenance Supervisor, in The Dalles.

We appreciate the opportunity to review and comment on your proposals.

S H Macnab
Stephen H. Macnab, P.E.
Region 4 Operations Engineer

SHM:br

CC: L. W. Rulien
Bruce Boyd
Chet Anderson
Tom Lowe

D R A F T

# RESERVOIR REGULATION MANUAL

# FOR

# JOHN DAY RESERVOIR

WALLA WALLA DISTRICT CORPS OF ENGINEERS

25 APRIL 1968

CORPS OF ENGINEERS

U.S. ARMY

MEAN SECTIONAL VELOCITIES AT SELECTED LOCATIONS IN THE JOHN DAY RESERVOIR

262 FOOT ELEVATION POOL AT JOHN DAY DAM

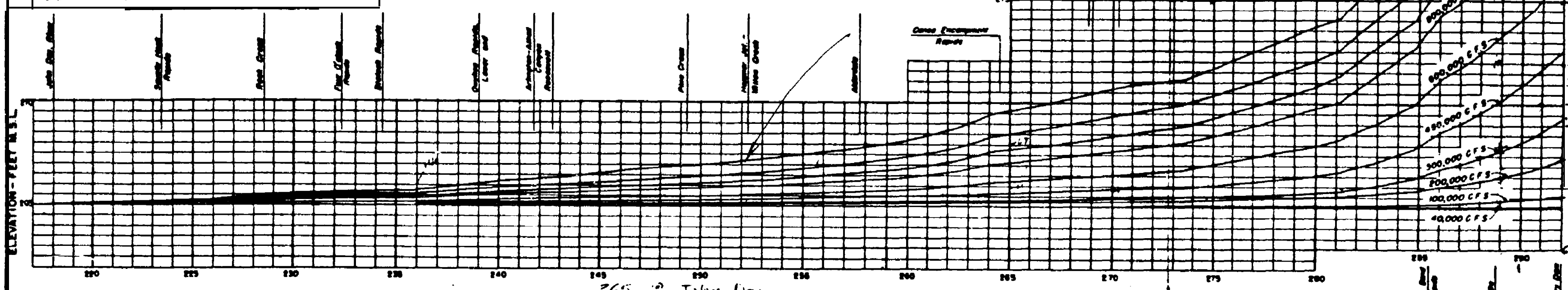
| River mile | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

MEAN SECTIONAL VELOCITIES AT SELECTED LOCATIONS IN THE JOHN DAY RESERVOIR

265 FOOT ELEVATION POOL AT JOHN DAY DAM

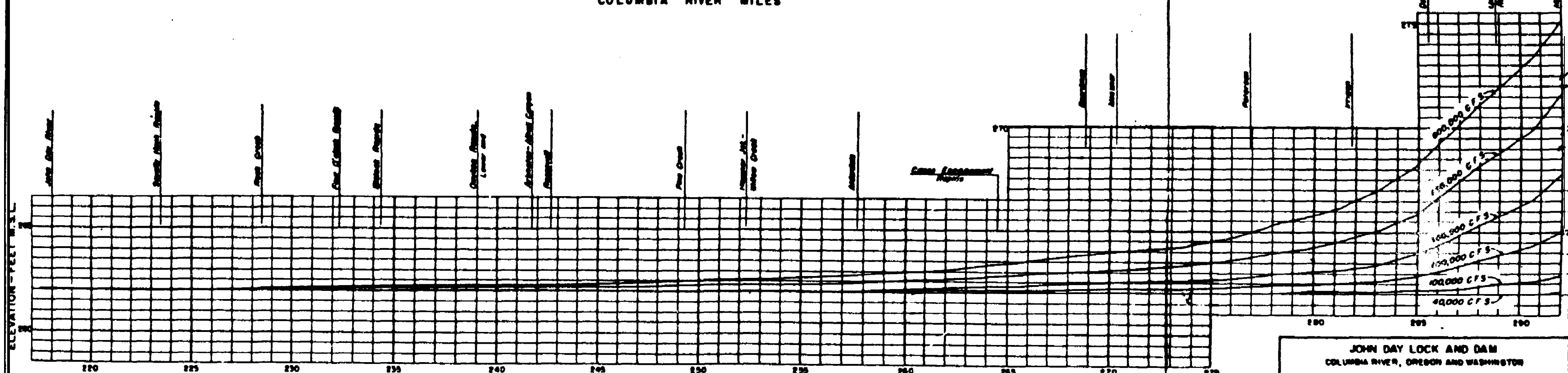
| River mile | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

265




265 @ John Day

COLUMBIA RIVER MILES




262 @ John Day

COLUMBIA RIVER MILES

262

JOHN DAY LOCK AND DAM

COLUMBIA RIVER, OREGON AND WASHINGTON

RESERVOIR BACKWATER PROFILES

262 AND 265 FOOT POOL ELEVATION AT DAM

WALLA WALLA DISTRICT, CORPS OF ENGINEERS

JD-05-5/17

Design Memorandum No. 1



455

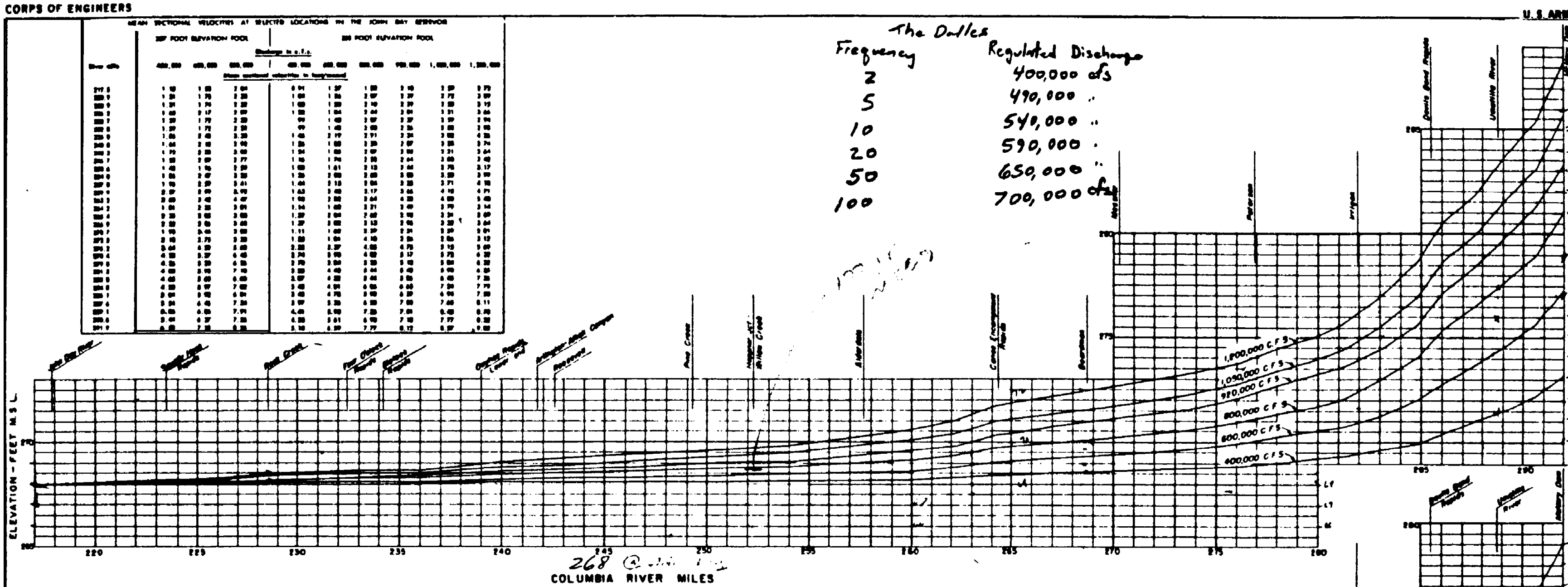
CORPS OF ENGINEERS — U.S. ARMY

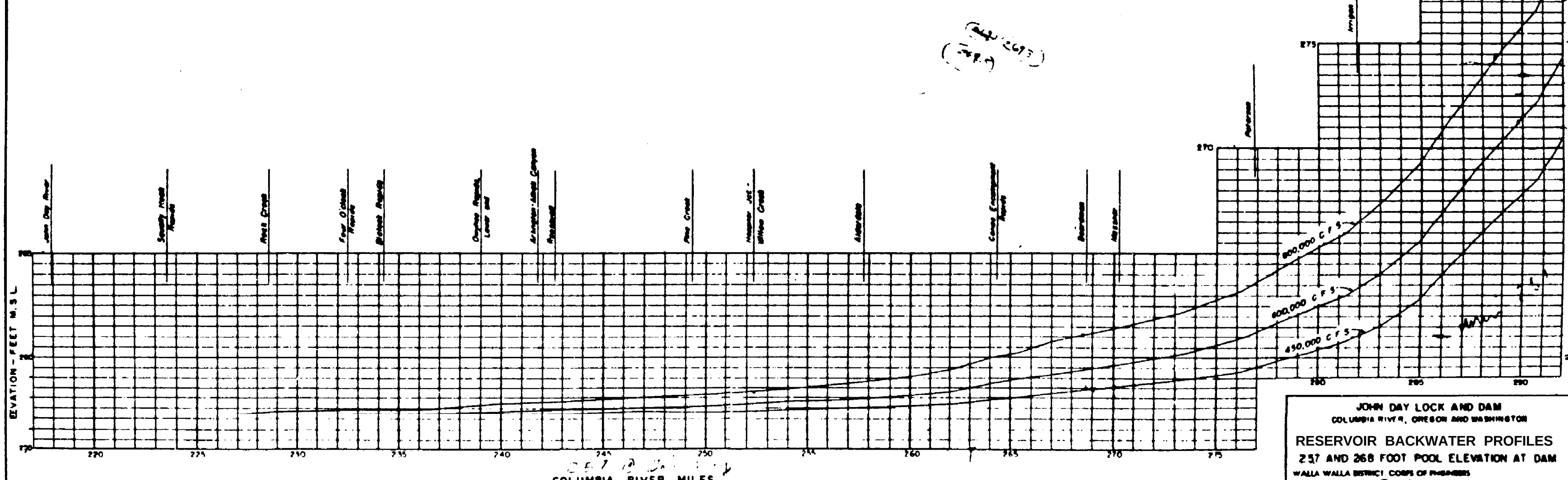
MEAN SECTIONAL VELOCITIES AT SELECTED LOCATIONS IN THE JOHN DAY RESERVOIR

| River mile | 257 FOOT ELEVATION POOL | | | 268 FOOT ELEVATION POOL | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

The Dalles

| Frequency | Regulated Discharge |
|---|---|
| 2 | 400,000 cfs |
| 5 | 490,000 " |
| 10 | 540,000 " |
| 20 | 590,000 " |
| 50 | 650,000 " |
| 100 | 700,000 cfs |




JOHN DAY LOCK AND DAM
COLUMBIA RIVER, OREGON AND WASHINGTON

RESERVOIR BACKWATER PROFILES
257 AND 268 FOOT POOL ELEVATION AT DAM

WALLA WALLA DISTRICT CORPS OF ENGINEERS

JD-05-5/18

APPENDIX B

LAND OWNERSHIP INFORMATION

MORROW COUNTY ASSESSOR'S OFFICE
GREG SWEEK, ASSESSOR
BOX 742
HEPPNER, OREGON 97836
(503) 676-9061

THREE MILE CANYON

April 29, 1987

Harold Anderson
Box 369
Bellview, WA 98009

RE: MAP REQUEST

Dear Mr. Anderson:

Enclosed is the map you requested. All the property in section 19 and section 20 is owned by the United States of America.

If you have any questions or comments please feel free to contact this office.

Sincerely,

Cyde Skroch

Cyde Skroch

WILLOW CREEK:
Gilliam County Assessor
PO BOX 484
Condon, OR 97823

all land owned by Fed. Govt.

# APPENDIX C

# GROUND WATER HYDROLOGY

REPORT OF GROUND WATER RESOURCE EVALUATION

WILLOW CREEK AND HAT ROCK ACCLIMATION FACILITIES

GILLIAM AND UMATILLA COUNTIES, OREGON

FOR THE

U.S. FISH AND WILDLIFE SERVICE



GeoEngineers
Incorporated

GeoEngineers
Incorporated

(206) 746-5200
Fax (206) 746-5068
2405 - 140th Ave N E
Bellevue, WA 98005

Consulting Geotechnical
Engineers and Geologists

May 18, 1987

Sverdrup Corporation
1200 - 112th Avenue Northeast
Bellevue, Washington 98009

Attention: Mr. Harold T. Andersen

Gentlemen:

We are submitting four copies of our report describing the results of our evaluation of the ground water resources at the proposed Willow Creek and Hat Rock acclimation facilities. The scope of our services is given in our technical services agreement with Sverdrup Corporation dated May 7, 1987.

We appreciate the opportunity to be of service and look forward to working with Sverdrup and the U.S. Fish and Wildlife Service in exploring and developing a ground water resource at the proposed acclimation facilities. Please call if you have any questions regarding our report.

Yours very truly,

GeoEngineers, Inc.

James A. Miller

James A. Miller
Principal

JHB:JAM:da

File No. 0758-10-4

# TABLE OF CONTENTS



## List of Figures

REPORT OF GROUND WATER RESOURCE EVALUATION
WILLOW CREEK AND HAT ROCK ACCLIMATION FACILITIES
GILLIAM AND UMATILLA COUNTIES, OREGON
FOR THE
U.S. FISH AND WILDLIFE SERVICE

## INTRODUCTION

The results of our evaluation of the potential for developing 5 to 17.5 cfs ground water supplies at the proposed Willow Creek and Hat Rock acclimation facilities are presented in this report. The locations of the Willow Creek and Hat Rock sites are shown on Figures 1 and 2, respectively.

Our evaluation of the potential for development of ground water supplies at the proposed facilities is based on a review of available water well reports and other geologic data.

## REGIONAL HYDROGEOLOGY

### GENERAL

The principal ground water aquifers in the region exist within the basalt flows of the Columbia River Basalt Group (CRBG). The basaltic lava flows that comprise the CRBG accumulated during a series of very large scale eruptions which occurred 10 to 17 million years ago. These basalt flows exist over a widespread area of eastern Oregon and Washington. Less extensive ground water aquifers exist on a localized basis within sediments that overlie the basalt flows.

Bedrock consisting of a thick sequence of layered basalt flows and associated sedimentary interbeds underlies both the Willow Creek and Hat Rock sites. The total thickness of the layered basalt flows may exceed 5000 feet with individual flows averaging about 100 feet thick. The individual basalt flows are often separated from each other by sedimentary interbeds (silt, sand or gravel) of varying thickness.

The stratigraphic relationship and nomenclature of the GRBG basalt flows and sedimentary interbeds which exist in the region are shown on Figure 3.

The central portion of the individual basalt flows is often very dense and is generally unproductive with respect to ground water supply. The upper portion of most basalt flows is vesicular with a honeycomb-like texture. This zone formed as gas bubbles rose toward the surface of the flow when the lava cooled. The upper vesicular zones of the lava flows are generally highly permeable and often form moderate to high-yield aquifers in the region.

Although the individual basalt flows exist over a relatively large area, the permeability of the upper vesicular zones normally varies from one location to another. The variation in permeability is often caused by the thinning of the vesicular zone and/or by secondary filling of the porous zone with clay or other minerals. The difference in permeability from one location to another results in a variable yield to water wells completed within the same vesicular zone.

The sedimentary interbeds which exist between the basalt flows in the Willow Creek/Hat Rock region are generally fine-grained and are not significant sources of ground water.

**WILLOW CREEK REGION**

The locations of the Willow Creek site and an alternative site at Threemile Canyon are shown on Figure 1. Nearly all of the water wells in the Willow Creek region obtain their supply from basalt aquifers. Data from water wells located in the Willow Creek region are summarized in Table 1. The following description of the Willow Creek site also applies to the Threemile Canyon site.

Extensive development of the ground water resource has occurred in the Horse Heaven Hills area, about 8 to 12 miles north of the site. Relatively shallow (<500 feet deep) wells located north of the Columbia River are capable of producing low to moderate (15 to 400 gpm) yields of water. Most water wells located in the Horse Heaven Hills are relatively deep (500 to over 1400 feet deep) and are capable of producing moderate to very high (750 to 7500 gpm) yields. Interpretation of geophysical logs suggest that the deep wells north of the site extend below the Mabton/Priest Rapids horizon. The deep wells encounter semi-confined aquifers which are often artesian. Artesian flows of over 2000 gpm have been reported for Wells 5N/23E-29Pl and 30. The Mabton sedimentary interbed and Priest Rapids basalt flow appear to act as a confining layer (aquitard) to regional ground water flow in the Horse Heaven Hills. Basalt aquifers above the Mabton/Priest Rapids horizon appear to be capable of supplying only low to moderate yields to water wells.

Water wells located south of the river in the Willow Creek region are generally shallower and less productive than wells located north of the river. Relatively shallow (<500 feet deep) wells located south of the river are capable of producing low to moderate (30 to 300 gpm) yields. Relatively deep (500 to 875 feet deep) wells south of the river are capable of producing moderate to high (100 to 1000 gpm) yields.

The deep basalt aquifers located south of the river are semi-confined but artesian flows have not been encountered. Geophysical logs of these wells are not available and it is uncertain whether the wells penetrate the Mabton/Priest Rapids horizon. Hence, it is also uncertain whether the Mabton/Priest Rapids horizon serves as an aquitard to regional ground water flow in the area south of the river.

It appears that the Elephant Mountain and/or Pomona basalt flows are exposed at the ground surface in the Willow Creek region. We estimate that the Mabton/Priest Rapids horizon would be encountered at a depth of 700 to 900 feet at the Willow Creek site.

HAT ROCK REGION

The location of the Hat Rock site is shown on Figure 2. Water wells located in the Hat Rock region obtain their supply from alluvial gravel above the basalt bedrock and from deeper basalt aquifers. Data from water wells in the Hat Rock region are summarized in Table 2.

Water wells located within a mile of the site (within Section 15) are relatively shallow (74 to 120 feet deep) and capable of producing low to moderate (30 to 500 gpm) yields. These wells obtain their supply from a gravel aquifer which appears to extend southwesterly from the site for a distance of about 3 miles (with Sections 16, 17, 20 and 21). Yields of up to 1500 gpm have been reported from shallow wells in Section 20.

Hat Rock and Ship Rock (located just east of Hat Rock) are isolated outcrops of basalt which project above the surrounding ground surface. Hat Rock and Ship Rock are the remnants of a basalt flow, probably the Pomona or

Umatilla flows, which was eroded by glacial floods about 11,000 years ago. The gravel aquifer near the site was probably deposited during these glacial floods.

The presence of basalt at the surface in close proximity suggests that the gravel aquifer is not extensive and may be absent at the site. The gravel aquifer is also relatively thin and does not appear to have a large horizontal extent. The relatively high yields reported on the water well records are from short-term pumping tests; and in our opinion, it is unlikely that the gravel aquifer could sustain the high yields over a long-term pumping program.

Wells located north and south of the Hat Rock and outside of the relatively small area in which the gravel aquifer exists, obtain their supply from basalt aquifers. Water wells located north of the river range in depth from about 300 to 1100 feet and are capable of supplying only relatively low yields ranging from 5 to 100 gpm. Relatively shallow (<350 feet) wells located south of the river are capable of producing low (20 to 75 gpm) yields. Relatively deep (380 to 600 feet deep) wells located south of the river are capable of producing low to high (40 to 1000 gpm) yields.

## GROUND WATER QUALITY

### GENERAL

The quality of ground water from the basalt aquifers beneath the Columbia Plateau is generally excellent. The concentration of dissolved oxygen is often low and may require aeration for use in acclimation facilities.

### GROUND WATER TEMPERATURE

Plots of ground water temperature versus the depth of the well for the Willow Creek and Hat Rock regions are shown on Figures 4 and 5, respectively. A relatively poor correlation exists between temperature and depth. This poor correlation is caused by several factors including the method of data collection. Most of the available temperature data were measured during pumping tests and recorded on water well reports. Water often enters the well at one or more depths that are shallower than the base of the well. The temperature measured during the pumping tests normally reflects the temperature of ground water from depths shallower than the base of the well.

Several of the deep well temperature data are bottom-hole temperatures which were measured during geophysical logging of wells located north of the river.

The available data indicate that ground water temperatures generally increase with increasing depth in the region. We understand that a water temperature above 20°C is detrimental to fish which will use the acclimation facilities.

The available temperature versus depth data indicate that ground water temperatures above 20°C may be encountered below 600 to 700 feet in the Willow Creek and Hat Rock regions. Ground water temperatures between 24 to 28°C may be encountered at a depth of 1000 feet.

## DISCUSSION AND RECOMMENDATIONS

### GENERAL

The potential for developing a 5 to 17.5 cfs ground water supply through completion of multiple water wells appears to exist at the Willow Creek site, The development of a 5 cfs supply at the Hat Rock site may not be feasible based on the relative absence of wells that obtain their water supply from high-yield basalt aquifers.

Ground water supplies obtained from below a depth of 600 to 700 feet may have to be mixed with shallower ground water and/or with surface water because of the higher than optimum temperatures expected in the deeper basalt aquifers.

### WILLOW CREEK SITE

Water wells have not been completed in close proximity to the Willow Creek site based on review of available information. Deep, moderate to very high yield, water wells have been completed within the basalt aquifers at locations which are several miles from the Willow Creek site.

On a preliminary basis, we estimate that a minimum of one to five wells will be needed to provide a S cfs supply at the Willow Creek site assuming that the well depths will range from 500 to 1000 feet and that moderate to very high yield aquifers are encountered. We estimate that a minimum of three to twenty wells would be required to provide a 17.5 cfs supply at the Willow Creek site based on the above assumptions.

We estimate that the wells should be located on 1000-foot centers to avoid excessive interference between the wells. Costs associated with piping and power requirements may be relatively high if only moderate yield aquifers are encountered. We expect that surface water would be needed to supplement the ground water supply to provide a 17.5 cfs flow if only moderate yield aquifers are encountered.

We recommend that a 1000-foot-deep test well be completed if siting of the acclimation facilities is anticipated at the Willow Creek or Threemile Canyon site.

The purpose of the test well includes:

1. Exploring shallow and deep basalt aquifer conditions.
2. Measuring water quality parameters in the aquifers that are encountered.
3. Providing information for the design of production wells.
4. Providing estimates of production well yield and pump requirements.

HAT ROCK SITE

Many shallow, moderate to high yield water wells have been completed in the gravel aquifer at locations within relatively close proximity of the Hat Rock site. As described earlier, the gravel aquifer, if present, does not appear to have the potential for providing a long-term S cfs supply at the site.

Deep water wells that are completed in the basalt aquifers and located several miles north of the site are capable of providing only low yields. Water wells that are completed in the basalt aquifer and located south of the river are generally capable of producing low yields with only occasional moderate to high yields reported. Data related to potential well yields for wells greater than 600 feet deep are not available for the region south of the river.

The potential for developing moderate to high yields from wells less than 600 feet deep appears low, The feasibility of developing moderate to high yields from wells deeper than 600 feet is relatively unknown but does not appear favorable at the Hat Rock site.

We recommend that a 1000-foot-deep test well be completed if siting of the acclimation facilities is anticipated at the Hat Rock site. The test well is intended to provide the following:

1. Explore for the presence and extent of the shallow gravel aquifer at the site.
2. Explore shallow and deep basalt aquifer conditions.
3. Measure water quality parameters in the aquifers encountered.
4. Provide information for the design of production wells.
5. Providing estimates of production well yield and pump requirements.

## TEST WELL

### GENERAL

We recommend that the test well be a minimum of 6 inches in diameter and extend to a depth of about 1000 feet. It is normally necessary to drill the shallower sections of the test well at a larger diameter in order to achieve the minimum 6-inch diameter in the deeper sections of the test well. Most deep wells in the basalts are drilled with three reductions in casing diameter. We recommend that the test well begin as a 10- to 12-inch-diameter bore.

### TEST PROGRAM

We further recommend that long-term pumping tests be conducted during and after completion of the test well. Pumping tests of over 72 hours may be necessary if very high yield aquifers are encountered.

Water quality parameters, including temperature, conductivity and pH, should be measured during the drilling and pumping tests. Water samples should be collected and analyzed for concentrations of dissolved metals and oxygen.

COST ESTIMATE

The following cost estimate should be considered as approximate because of the relatively uncertain nature of the hydrogeological conditions that will be encountered during test well construction. Costs may also vary with the time of well construction due to variable demand for drilling services and fluctuations in costs for well materials.

We estimate that construction and pump testing of a 1000-foot-deep test well will cost about $35,000 to $45,000. We further estimate that costs for monitoring well construction and pump testing activities, analyzing pumping test data, and providing design parameters for production wells will range between $10,000 to $15,000. We expect that the total cost for the test well will range between $45,000 and $60,000. These estimated costs do not include provisions for difficult access conditions.

Sustained high to very high yields from the test well may not be possible because of the relatively small diameter of the test well. It may prove more economical to construct a K&inch-diameter "test" production well, especially at the Willow Creek site. The larger-diameter well could be utilized at the proposed facilities at a higher pumping rate if high to very high yield aquifers are encountered. We estimate that installation of the 12-inch-diameter well would increase well construction costs by about $35,000 to $40,000.

**SUMMARY**

The potential for developing a 5 to 17.5 cfs ground water supply appears to greater at the Willow Creek site as compared to the Hat Rock site. Site-specific data are not available at either sites. We recommend that a test well be completed prior to finalizing plans for the acclimation facilities.

## USE OF THIS REPORT

We have prepared this report for use by Sverdrup Corporation and by the U.S. Fish and Wildlife Service. Our recommendations are based on a review of available hydrogeologic data and considerable judgment. Although the ground water supply potential appears promising at the Willow Creek site and less favorable at the Hat Rock site, our interpretations and recommendations should not be construed as a warranty of subsurface conditions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No other conditions, express or implied, should be understood.

- o 0 o -

We appreciate the opportunity to be of service. Please call if you have any questions regarding our report.

Respectfully submitted,

GeoEngineers, Inc.

John H. Biggane

John H. Biggane
Geological Engineer

James A. Miller

James A. Miller
Principal

JHB:JAM:wd

TABLE 1 SUMMARY OF WATER WELL DATA - WILLOW CREEK REGION

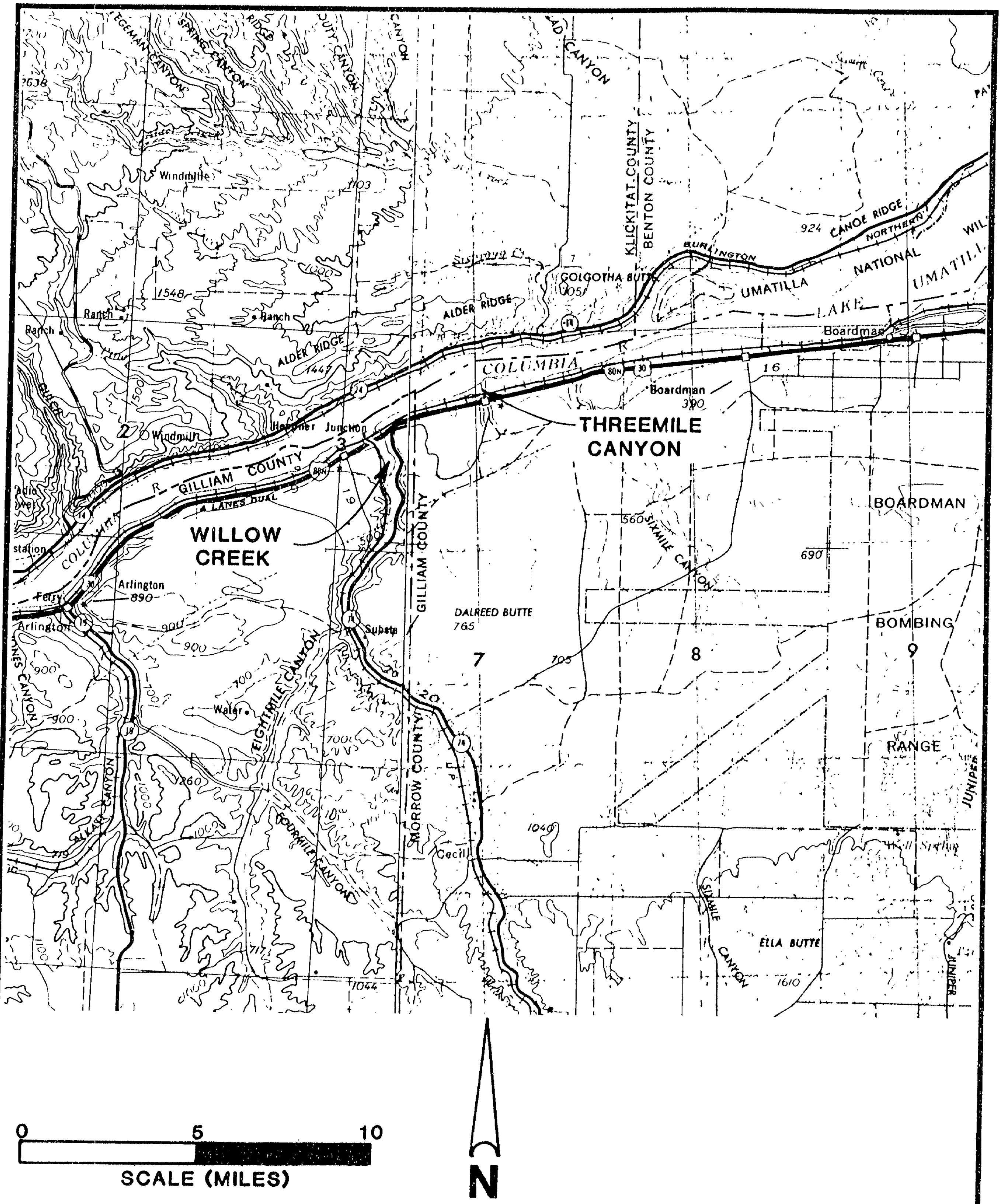
| WELL NUMBER (TN/RG-SEC) | DEPTH (FEET) | DEPTH TO STATIC WATER LEVEL (FEET) | YIELD (GPM) | SPECIFIC CAPACITY (GPM/FT. /FT. OF DRAWDOWN) | AQUIFER | TEMPERATURE (CELCIUS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| 3N/22E-2 | 465 | 341 | 75 | 0.8 | BASALT INTERBED | | |
| 3N/22E-14F1 | 527 | 65 | 100+ | - | BASALT | 17.8 | DRAWDOWN NOT REPORTED |
| 3N/22E-14B1 | 325 | 104 | 200 | - | BASALT | | DRAWDOWN NOT REPORTED |
| 3N/22E-23 | 348 | 100 | 30 | 0.3 | BASALT | | |
| 3N/22E-23 | 93 | 29 | 50 | 0.8 | BASALT | | |
| 3N/22E-23C1 | 275 | 175 | 75 | 1.5 | BASALT | | |
| 3N/22E-23E1 | 340 | 125 | - | - | BASALT | | |
| 3N/22E-23P1 | 263 | 120 | 40 | - | BASALT | | DRAWDOWN NOT REPORTED |
| 3N/22E-26 | 153 | 30 | 5 | 0.1 | CLAY | | |
| 3N/22E-35K1 | 406 | 225 | 160 | 1.0 | BASALT | | |
| 3N/23E-3F1 | 740 | 193 | 346 | 9.9 | BASALT | 12.2 | |
| 3N/23E-3G1 | 843 | 245 | 376 | 6.8 | BASALT | 12.7 | DRILLER REPORTS 800 GPM MAX YIELD |
| 3N/23E-4B1 | 832 | 230 | 346 | 4.1 | BASALT | 12.7 | DRILLER REPORTS 800 GPM MAX YIELD |
| 3N/23E-9 | 700 | 150 | 200 | 0.8 | BASALT | | DRILLER REPORTS 800 GPM MAX YIELD |
| 3N/23E-9R1 | 700 | 277 | - | - | BASALT | | |
| 3N/23E-25 | 564 | 198 | 725 | 7.3 | BASALT | | |
| 3N/23E-25F1 | 790 | 152 | 750 | 26.8 | BASALT | | |
| 4N/22E-3N1 | 45 | 21 | - | - | GRAVEL | | |
| 4N/22E-7J1 | 38 | 26.7 | - | - | - | | |
| 4N/22E-12 | 547 | - | - | - | - | | DRY WELL |
| 4N/22E-34 | 157 | - | LOW | - | BASALT | | |
| 4N/22E-35D1 | 305 | 0 | - | - | BASALT | | |
| 4N/23E-9R | 260 | 150 | 45 | - | BASALT | | DRAWDOWN NOT REPORTED |
| 4N/23E-27N1 | 875 | 281 | 1000+ | - | BASALT | 14.4 | DRAWDOWN NOT REPORTED |
| 4N/23E-35D1 | 100 | 25 | 300 | 4.3 | BASALT | | |
| 4N/24E-6J1 | 432 | 38 | - | - | GRAVEL/BASALT | | NO PUMP TEST DATA AVAILABLE |
| 5N/22E-13Q1 | 74 | FLOWING | 12 | - | BASALT | | ARTESIAN FLOW OF 12GPM |
| 5N/22E-25F | 834 | +74 | 7500 | 68.2 | BASALT | | ARTESIAN WELL |
| 5N/22E-27 | 787 | 58 | - | - | BASALT | | NO PUMP TEST DATA AVAILABLE |
| 5N/22E-27A1 | 775 | 54 | 900 | 3.7 | BASALT | 21.1 | |
| 5N/22E-27A2 | 860 | 72 | 1806 | 12.5 | BASALT | 22.2 | |
| 5N/22E-27A3 | 1061 | 27 | 750 | 15.0 | BASALT | 28.1 | |
| 5N/22E-27Q1 | 812 | 115 | 2500 | 250.0 | BASALT | | |
| 5N/23E-3A1 | 1100 | 256 | 750 | 750+ | BASALT | 17.7 | ZERO DRAWDOWN REPORTED AT 750GPM |
| 5N/23E-3L1 | 150 | 125 | 95 | - | BASALT | 16.0 | |
| 5N/23E-3L2 | 313 | 190 | 400 | 28.6 | BASALT | | |
| 5N/23E-13 | 1446 | 128 | - | - | BASALT | | NO PUMP TEST DATA AVAILABLE |
| 5N/23E-13 | 776 | - | - | - | BASALT | | NO PUMP TEST DATA AVAILABLE |
| 5N/23E-13R1 | 1081 | 144 | 2990 | 213.6 | BASALT | 28.8 | |
| 5N/23E-27A1 | 1040 | 27 | - | - | BASALT | | |
| 5N/23E-29D1 | 875 | + | 5170 | 15.9 | BASALT | 22.2 | ARTESIAN FLOW OF 2120 GPM |
| 5N/23E-30 | 843 | +12 | 4650 | 15.3 | BASALT | | ARTESIAN FLOW OF 2500 GPM |
| 5N/23E-35C | 250 | 220 | 15 | 2.5 | NO LOG | 12.2 | |

TABLE 2 SUMMARY OF WATER WELL DATA - HAT ROCK REGION

| WELL NUMBER (TN/RG-SEC) | DEPTH (FEET) | DEPTH TO STATIC WATER LEVEL (FEET) | YIELD (GPM) | SPECIFIC CAPACITY (GPM/FT. /FT. OF DRAWDOWN) | AQUIFER | TEMPERATURE (CELCIUS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| 5N/29E-15 | 92 | 46 | 300 | 7.9 | GRAVEL | | |
| 5N/29E-15 | 87 | 44 | 500 | 13.9 | GRAVEL | | |
| 5N/29E-15 | 96 | 62 | 500 | 17.9 | GRAVEL | | |
| 5N/29E-15 | 74 | 38 | [illegible] | 3.1 | GRAVEL | | |
| 5N/29E-15 | 95 | 36 | 30 | 2.0 | GRAVEL | | |
| 5N/29E-15N1 | 120 | 63.5 | 30+ | 30+ | GRAVEL | 12.2 | ZERO DRAWDOWN REPORTED AT 30GPM |
| 5N/29E-16G1 | 92 | 66 | 200 | 7.7 | GRAVEL | 14.4 | |
| 5N/29E-17D1 | 75 | 45 | 400 | 16.0 | GRAVEL | | |
| 5N/29E-20E1 | 203 | 53 | 100 | 0.8 | BASALT | | |
| 5N/29E-20G1 | 33 | 14 | 25 | 12.5 | GRAVEL/BASALT | | |
| 5N/29E-20R1 | 22 | 8 | 1500 | 75.0 | GRAVEL | | |
| 5N/29E-20R2 | 27 | 8 | 1000 | 37.0 | GRAVEL | | |
| 5N/29E-21 | 130 | 14 | 12 | 0.2 | BASALT | | |
| 5N/29E-21A1 | 95 | 53 | 700 | 18.9 | GRAVEL | | |
| 5N/29E-21E1 | 632 | 61 | 400 | 1.1 | BASALT | | |
| 5N/29E-21E2 | 21 | 8 | 30 | 6.0 | GRAVEL/BASALT | | |
| 5N/29E-22 | 100 | 20 | 40 | 2.0 | BASALT | | |
| 5N/29E -22 | 3 | 47 | 40 | 0.3 | BASALT | | |
| 5N/29E -22 | 263 | 153 | 35 | 0.4 | BASALT | | |
| 5N/29E -22 | 1 ?7 | 60 | 60 | 3.0 | BASALT | | |
| 5N/29E-22D1 | 398 | 54 | - | - | BASALT | | |
| 5N/29E-22P1 | 183 | 55 | 75 | - | BASALT | 14.4 | DRAWDOWN NOT REPORTED |
| 5N/29E-23 | 224 | 66 | 20 | 0.2 | BASALT | | |
| 5N/29E-26 | 603 | 150 | 40 | 0.3 | BASALT | | |
| 5N/29E-26F1 | 925 | | - | - | BASALT | | |
| 5N/29E-26M1 | 380 | 59 | 400 | 1.7 | BASALT | | |
| 5N/29E-26M2 | 525 | 15 | - | - | BASALT | | |
| 5N/29E-26Q1 | 490 | 76 | 200 | -- | BASALT | 13.9 | DRAWDOWN NOT REPORTED |
| 5N/29E-27 | 110 | 21 | - | - | BASALT | 16.7 | |
| 5N/29E-27 | 217 | 30 | - | - | BASALT | 15.5 | |
| 5N/29E -28 | 487 | 65 | 1 000 | 2.6 | BASALT | | |
| 5N/29E-31P1 | 180 | 32 | - | - | BASALT | | |
| 5N/29E-31F1 | 201 | 10 | - | -- | BASALT | | |
| 5N/29E-32L1 | 200 | 45 | - | - | BASALT | | |
| 5N/29E-32P1 | 1 60 | - | - | - | BASALT | | |
| 5N/29E-34B1 | 428 | | - | - | BASALT | | |
| 5N/30E-19A1 | 685 | 345 | 42 | 0.2 | BASALT | | |
| 5N/30E-31 | 1008 | 300 | 200 | 1.0 | BASALT | | |
| 6N/29E-11P1 | 1110 | 1070 | 5 | - | BASALT | | |
| 6N/29E-23K1 | 330 | 309 | 25 | | BASALT | | |
| 6N/30E-12Q1 | 974 | 855 | - | - | BASALT | 21.0 | |
| 6N/30E-19D1 | 814 | 634 | 100 | 14.3 | BASALT | 23.3 | |
| 6N/30E-19N1 | 706 | 695 | III | - | BASALT | 12.7 | DRAWDOWN NOT REPORTED |



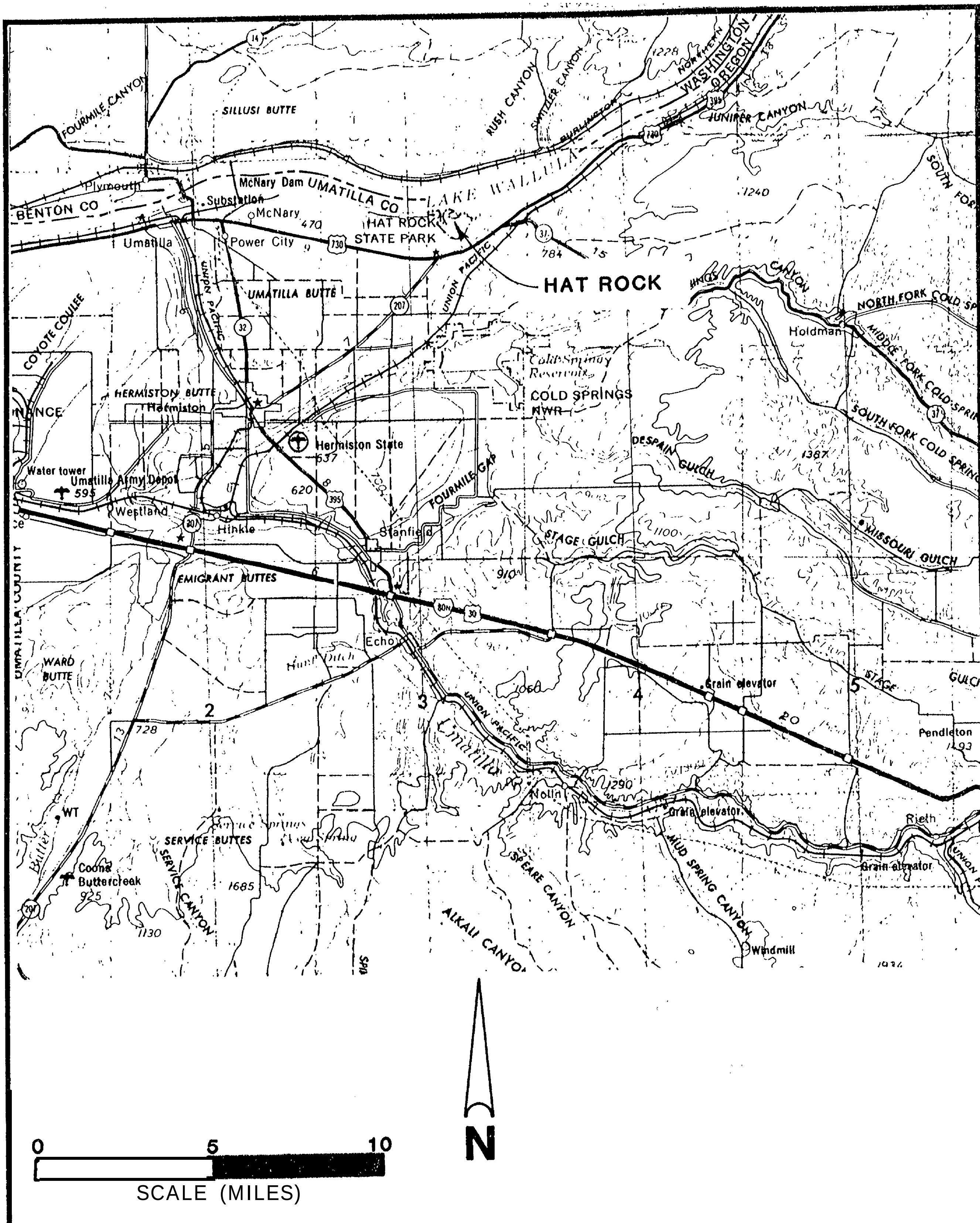
GeoEngineers Incorporated




REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAPS, (SCALE 1:250,000), "THE DALLES, OR." AND "PENDLETON, OR."

GeoEngineers Incorporated

| VICINITY MAP - WILLOW CREEK |
| --- |
| FIGURE 1 |

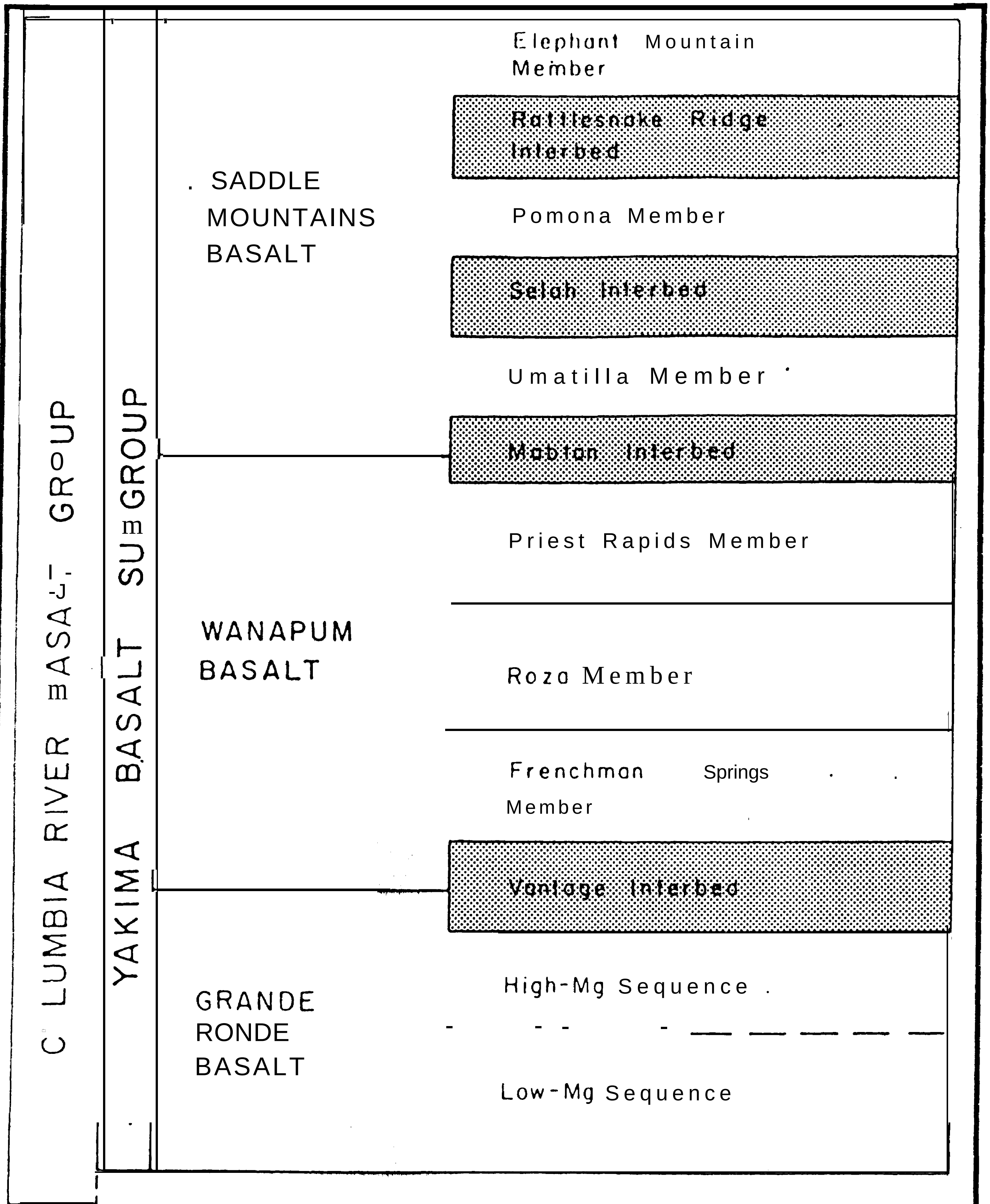



REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAP, (SCALE 1:250,000), "PENDLETON, O R . "

GeoEngineers Incorporated

**VICINITY MAP - HAT ROCK**

**FIGURE 2**

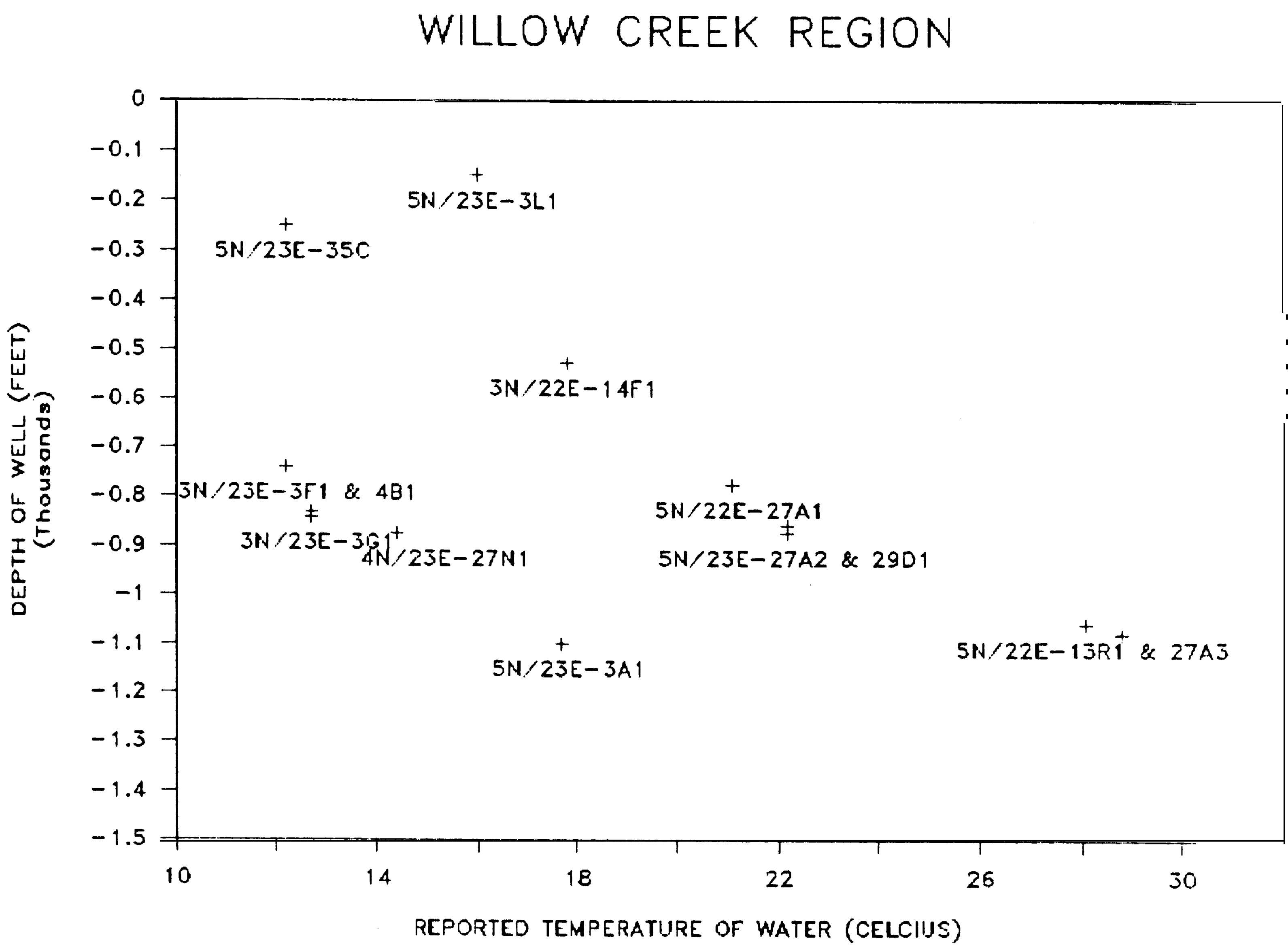



GeoEngineers Incorporated

**STRATIGRAPHIC RELATIONSHIP AND NOMENCLATURE**

**FIGURE 3**

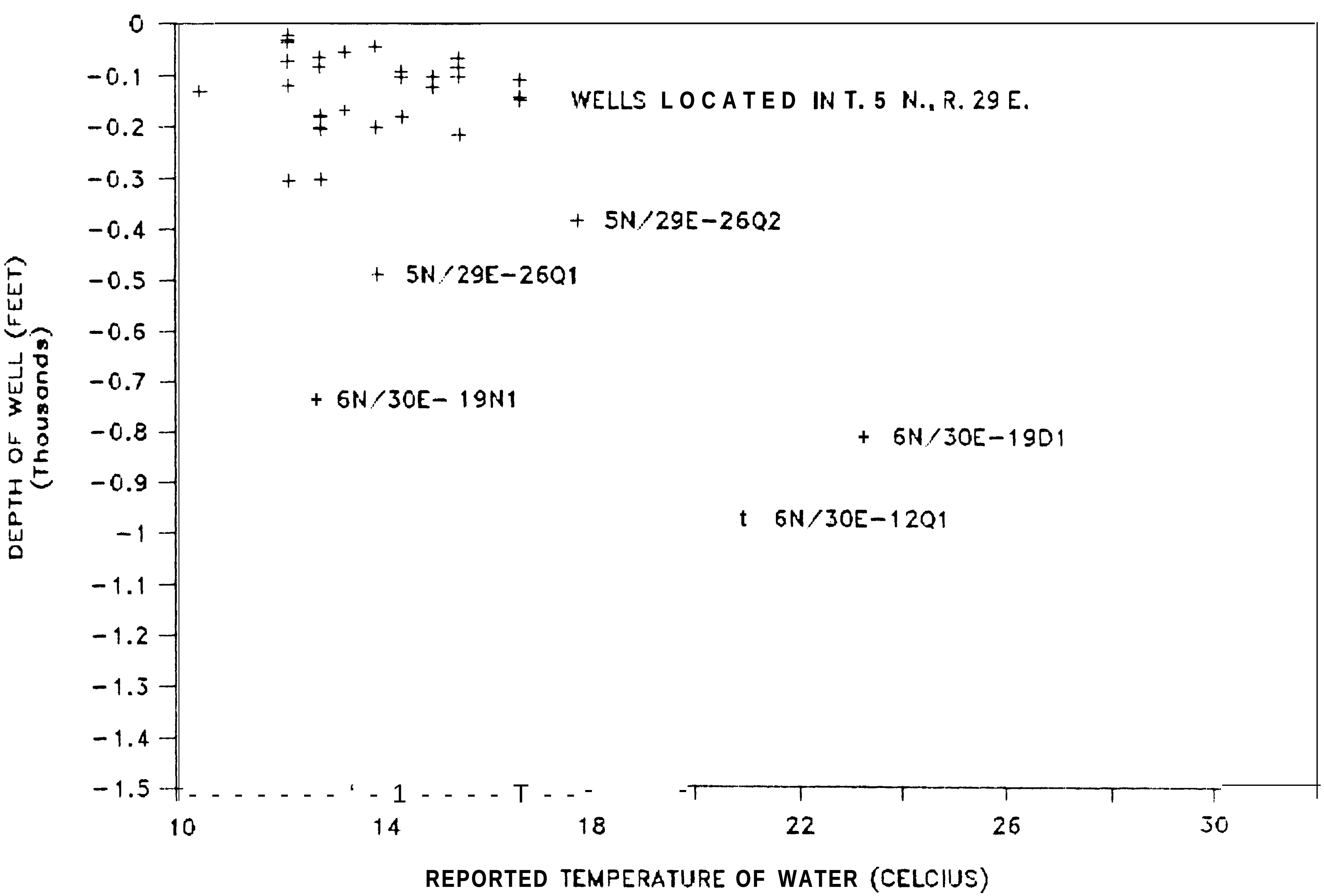
GeoEngineers Incorporated




GROUND WATER TEMPERATURE - WILLOW CR...

FIGURE 4

# HAT ROCK REGION




GeoEngineers Incorporated

GROUND WATER TEMPERATURE - HAT ROCK

FIGURE 5

# APPENDIX D

# WATER QUALITY RESULTS

AT am test inc.
14603 N.E. 87th • REDMOND, WASHINGTON 98053 • 206/885-1664

# ANALYSIS REPORT

CLIENT: Sverdrup

DATE RECEIVED: 5/27/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 5/31/87

| Laboratory Sample Nos. | Client Identification | Total Kjeldahl Nitrogen (mg/l) | Total Dissolved Solids (mg/l) | pH |
|---|---|---|---|---|
| 704320 | 3 Mile Canyon | 0.272 | 145. | 8.0 |
| 704321 | Willow Creek | 0.300 | 168 | 8.1 |
| 704322 | Hat Rock | <0.20<br><0.20] | 611 | 8.0<br>8.1] |
| 704874 | Ringold Spr. | <0.20 | 506. | 8.0 |
| 704875 | Ringold WW | 0.438 | 371. | 8.5 |
| 704876 | Prosser | 0.388 | 220. | 7.4 |
| 704887 | Walla Walla | 0.355 | 398. | 8.0 |

REPORTED BY John T. Dailey
John Dailey

JD/pb

am test inc.
14603 N.E. 87th • REDMOND, WASHINGTON 98053 • 206/885-1664

# ANALYSIS REPORT

**CLIENT:** Sverdrup Corporation

DATE RECEIVED: 4/24/87

**REPORT TO:** Gary Wiggins
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 5/15/87

| Laboratory Sample Numbers | 704320 | 704321 | 704322 |
|---|---|---|---|
| Client Identification | 3-Mile Canyon | Willow Creek | Hat Rock |
| Alkalinity (mg/l as $CaCO_3$) | 69.5 | 90.0 | 289.<br>281.] |
| Ammonia (mg/l as $NH_3$-N) | 0.080 | 0.062 | 0.028 |
| Chloride (mg/l) | 1.8 | a . | 62.2<br>61.2] |
| Dissolved Oxygen (mg/l) | 13.2 | 13.8 | 9.6 |
| Nitrate (mg/l as $NO_3$-N) | 0.380 | 0.283 | 2.43 |
| Nitrite (mg/l) | 0.010 | 0.012 | <0.001 |
| Total Suspended Solids (mg/l) | 34. | 27. | 2. |
| Settleable Solids (mg/l) | <0.1 | 0.1 | <0.1 |
| Copper (mg/l) | 0.007 | 0.012<br>0.011] | 0.002 |
| Zinc (mg/l) | 0.120 | 0.267<br>0.267] | 0.124 |

481

REPORTED BY John T. Daily for
Donald Sitkei

DS/pb

# JOHN DAY FALL CHINOOK/SALMON MITIGATION PLAN
# ACCLIMATION AND IMPRINTING
# SITE FEASIBILITY STUDY
# WALLA WALLA SITE

Completion Report

by

U.S. FISH AND WILDLIFE SERVICE
Portland, Oregon

and

SVERDRUP CORPORATION
Bellevue, Washington

Funded by

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION
DIVISION OF FISH AND WILDLIFE
CONTRACT NO. **14-16-0001-84078**
PROJECT NO. ________

September 1987

TABLE OF CONTENTS

## LIST OF TABLES

Page

Table



## LIST OF FIGURES

Figure



## APPENDICES

# I INTRODUCTION

The Walla Walla site is one of 10 locations being considered for an acclimation facility as part of the John Day fall Chinook Salmon Mitigation Plan. This report presents results from an engineering feasibility study of the Walla Walla site,

# II SITE INFORMATION

## A. Location

The Walla Walla site is on the Bergevin farm adjacent to State Route 12 (SR12) about 1 mile west of Lowden, Washington. Lowden is 19 miles from downtown Walla Walla. The farm property is bordered on the north by SR12 and on the east by Lowden Road. On the south the Walla Walla River borders and crosses the property. The west boundary is the section line between Ranges 33 and 34 East. The farm is in Sections 30 and 31, Township 7 North, Range 34 East. Figure 1 is a Location Map and Figure 2 is a Vicinity Map of the site.

## B. Land Ownership

The project site is In private ownership by the individual shown in Appendix B. For the fish rearing concept envisioned, a small amount of work will be necessary on two adjoining pieces of privately owned property (these owners are also shown in Appendix B). The proposed work will also affect Lowden Road, which is owned and maintained by Walla Walla County.

## C. Site Description

The property is an active farm. Current crops include asparagus, alfalfa, potatoes, and barley. The entire parcel comprises 240 acres. Improvements include a residence, two barns, buried pipe lines and open ditches for irrigation, a seasonal river water pump station, fences, and access roads. The Wall a Wall a River runs the entire east-west length of the property, mostly along the south property line. Dry Creek confluences with the river just east of the east boundary. The Walla Walla River has been straightened over the years and two partially filled river oxbows remain on the property. One holds water and has 6 foot depths reported. The other is more of a marsh or wetland. There is also a drainage ditch on the Bergevin farm and the adjacent upstream parcel to the east, It was built to drain low, wet areas. The lower end of this ditch is currently being used to raise steelhead trout through a cooperative program involving the Washington Department of Game, the Tri-State Steelhead Club, and the land owner. Each year in early April, 50,000 steelhead smolts from the Lyons Ferry Hatchery are stocked in the ditch. Roughly 80 percent remain until May 1, 10 percent stay another two weeks, and the remaining 10 percent never leave. Also in early April, 50,000 steelhead smolt are released directly into the river at this location.

In addition to the land, the owner also has water rights from the Wall a Wall a River, categorized by winter and Summer uses. The winter right (generally September 1 to June 1) is for 211 acres of water 4.17 feet deep. The summer right is 70 acres, 4.17 feet deep. (This right is old and at that time 4.17 feet was considered necessary to irrigate one acre of land for one year.) The total right converts to 1,172 acre-feet per year. Water withdrawn uniformly at this rate over a year's time would amount to 1.62 cubic feet per second (cfs). If it were' physically and legally possible to take all this right in one month, the flow rate would be 19.4 cfs.

D. Access and Services

The project site is on SR12 and Lowden Road. Several farm roads exist on the property. Access is excellent. Services may be obtained in Lowden (1 mile east) or in Walla Walla (20 miles east). Touchet, 5 miles to the west, also has services.

E. Soils and Vegetatoin

The USDA Soil Conservation Service (SCS) has classified three predominant soil types in the project area: Catherine silt loam, Esquatzel very fine sandy, loam and Pedigo silt loam. These soils are quite fertile with moderate to low permeability. Generally, they are suitable for supporting structures.

Vegetation consists of the intensively managed farm crops and large trees along the upper portions of the Walla Walla River and near the residence.

## F. Flood

Walla Walla River flow records from 1953 to 1979 at a gaging station approximately 7 miles downstream are listed in Appendix C. During this period the mean, maximum, and minimum discharges for May were 741.2, 1,372.0, and 60.6 cfs, respectively. The drainage area at this location contains 1,007 more square miles than the 650 square mile drainage area tributary to the Bergevin farm. A straight proportion suggests that the gaging station flows should be reduced by 61 percent to obtain project site flows.

The Federal Emergency Management Authority (FEMA) has predictions for 100 year recurrence interval floods at locations upstream and downstream from the Bergevin farm. The upstream location, approximately 21,000 feet east, has a predicted flood level at elevation 556.5. At 11,000 feet downstream the elevation is 450.5. The FEMA location flood depth is about 6 feet upstream and 10 feet downstream. The property owner reports that January floods have inundated his property with 2 to 3 feet of water twice in the past 40 years. The ground on the level portions of the farm are generally 12 feet above the river bed at this location.

## G. Utilities

The Bergevin farm is within the Pacific Northwest Bell (PNB) and the Pacific Power and Light (PP&L) service areas. PNB headquarters are in Spokane, Washington and a PP&L office is in Walla Walla.

These utilities have service to the farm residence and to neighbors in the immediate area. Both companies have been contacted to obtain a cost estimate for extending lines to the project site (refer to Appendix A).

Domestic water for the residence is from a 70 foot deep well. Sewage disposal is with a septic tank and soil absorption system. Solid waste is hauled to the county landfill at Touchet.

## H. Cultural Resources

There are no known or suspected cultural resources at this site and, due to the existing land use and type of facility proposed, construction could proceed without further archaeological investigations.

# III DEVELOPMENT CONCEPTS

Rearing chinook fry on the Bergevin farm would most appropriately be done in the existing drainage channel and old river oxbow. Raceway or pond improvements proposed elsewhere do not appear suitable to this site. The land is currently being farmed and purchase would very likely be required to take it out of production. Other than the existing steelhead program, this site dues not have any particular merit as a fisheries facility. The drainage ditch. flow rate is low, ground water from wells likely would have 500 foot pumping heads, and it may be difficult to pump from the river.

## A. Steel head Pond

The existing steelhead pond (drainage ditch) has roughly 28,000 cubic feet of volume and has had maximum stocking of 50,000 steelhead smolts (roughly 5,000 pounds). Flow into the pond varies and fewer fish are stocked during years when it is low. On June 22, 1987, the flow rate was approximately 0.2 cfs. For 5,000 pounds of smolts, the flow density would be 0.02 pounds per gallon per minute (gpm). The volume density would be 0.2 pounds per cubic foot.

The drainage ditch flow comes from shallow ground water found in the unassorted and rounded basaltic pebbles that underlay the Touchet silt loam soil complex on the adjacent easterly property. The SCS reports that the seasonal water table rises to within 39 to

64 inches of the ground surface and that the pebble layer begins at a depth of 64 inches. The ditch invert now is at least 60 inches below ground surface. The property owner reports that the ditch had higher flows when it was initially constructed. The reduced flows can logically be attributed to siltation of the ditch bottom. It seems possible, therefore, that flows could be increased (at least temporarily) by deepening and lengthening the ditch. The amount of flow that could be obtained is unknown.

Widening, deepening, and lengthening the ditch to 8, 5, and 1,700 feet, respectively, on the Bergevin property would yield a total water volume of 68,000 cubic feet. The ditch would also have to be enlarged on the property to the east to increase flow rates. Using the new volume and 0.2 pounds per cubic foot stocking density, 13,600 pounds of chinook salmon could be held. This is 1,360,000 fry at 100 per pond or 272,000 smolt at 20 per pond. If the ditch improvements total yield were 5 cfs (this is highly speculative), the flow density would be 6 pounds per gallon per minute.

No other source of water is planned for this ditch. If the flow rate developed by lengthening and deepening the ditch upstream does **not produce enough water, production suggested above must be** reduced. Additionally, it is felt that the ditch water will be sufficiently unique to imprint fish to this site.

Physical improvements required for the steelhead pond include:

- Lengthening and deepening the drainage ditch on the property to the east.
- Replacing the culvert under Lowden Road.
- Widening, deepening, and lengthening the pond on the Bergevin farm property.
- Installation of a new outlet structure into the Walla Walla River.
- Installation of a fry barrier at the culvert under Lowden Road,

B. Oxbow Pond

The oxbow pond is roughly 1,800 feet in total length. The west half is 900 feet long, 40 feet wide, and (according to the owner) 6 feet deep. The remaining portion is 30 feet wide and only 2 feet deep. It is currently supplied by small quantities of irrigation water. The outlet to Walla Walla River is through a small diameter pipe. There is about 220 feet between the end of the pond and the river. At this location the river is on land owned by an adjacent neighbor. To make the pond suitable for fish rearing, improvements to the pond outlet would be necessary and, therefore, the owner's approval would be required.

The lower (west) half of the pond contains roughly 200,000 cubic feet of water volume in its current configuration. For this study the 200,000 cubic feet is all that was considered. The upper half was ignored because it is unlikely enough water could ever be available to supply such a large volume. If the 0.2 pcf density were used here, 200,000 cubic feet of volume could hold 40,000 pounds of fish. At 6 pounds per gallon per minute this would require 15 cfs. (For comparison, WDF stock their 83,000 cubic foot asphalt lined 1/2 acre ponds with 50,000 pounds of chinook fry and provide a 10 cfs flow rate. This results in a flow density of 11.1 lbs/gpm and a loading density of 0.6 pcf.)

For the oxbow pond the most economical way to provide 15 cfs would be by pumping from the river. However, straight river water would not necessarily produce imprinting to this particular site. Therefore, 1 to 2 cfs of ground water is proposed to supplement 13 to 14 cfs of river water. A water right from the Washington Department of Ecology (WDOE) would be necessary for both a well and river pump station. WDOE's Spokane district office was contacted to ask if such water rights would be difficult to obtain. Since this would be a non-consumptive use with discharge back into the river very near the intake, the WDOE response was that a water right could probably be obtained.

To supply 13 to 14 cfs, a river water pump station would be necessary. However, it will be expensive to construct a pump station at this location that works well at various stages of river flow. This is particularly true at times when the river has a high silt or debris load. Riprap of both river banks will be required to hold the river against the river water intake. To avoid pumping, a river realignment back through the oxbow has been considered. However, it is very unlikely that this could be done successfully. Resulting erosion, problems with river gradient, and likely damage to fish containment structures have caused this idea to be rejected. A ground water well for 1 to 2 cfs supply would probably be 500 feet deep. The pump size would be 160 horsepower compared to 60 horsepower for river water pumps.

A river water pump station and well, 250 feet of 10 inch and 400 feet of 24 inch pipe, a new outlet structure into the river, and net fences to contain various lots of fish would be necessary to make the oxbow suitable for rearing.

## C. Support Facilities

Total fish production possible at this site is roughly 13,600 pounds in the steelhead pond and 40,000 pounds in the oxbow pond based on the assumptions stated. For comparison, the Oregon sites were each planned for 30,000 pounds. They have more manageable and permanent rearing structures and support facilities - consisting of housing/office space, a fish food freezer/preparation building, security fencing, and adult capture/spawning structures. These same improvements do not seem reasonable for Walla Walla.

If the project had some particular feature that made it more suitable for fry rearing, such as large volumes of gravity water, or if it were on public land available at low cost, a more permanent facility would be appropriate. Since this is not the case, it is not economical to purchase the land and then construct costly improvements on it. This is particularly true when considering the difficulty in maintaining a river water pump station. Instead, it is recommended that extensiverearing be done in the steelhead pond only, or in both ponds, and that the only support facility be a freezer van parked on-site. Table 1 is a construction cost summary for these improvements.

## IV WATER QUALITY AND TEMPERATURE

Water samples were collected from the steelhead pond outlet and the Walla Walla River on May 5 and June 22, 1987, respectively. All samples were taken to AM Test in Redmond, Washington for analysis. Complete results are shown in Appendix E.

Steelhead pond water had concentrations of ammonia, chloride, and zinc in excess of the maximum levels listed in the USF&W proposal to Bonneville Power Administration. All other constituents tested for were less than the recommended maximums. The pond outlet water temperature on May 5, 1987 was 62 degrees F. On June 22, 1987 water temperature at the pond inlet was 59 degrees F and 67 degrees F at the outlet.

River water had concentrations of ammonia, chloride, zinc, and nitrate in excess of the maximum levels. The pH was slightly higher than that preferred. The water temperature on June 22, 1987 was 76 degrees F.

# V COST SUMMARY

Two concepts that can be used together or separately are proposed at Walla Walla. They are rearing in an improved existing steelhead pond and the existing oxbow pond. Construction cost estimate summaries exclusive of acquisition or professional services fees are shown in Table 1.

- TABLE 1 -

WALLA WALLA COST SUMMARY

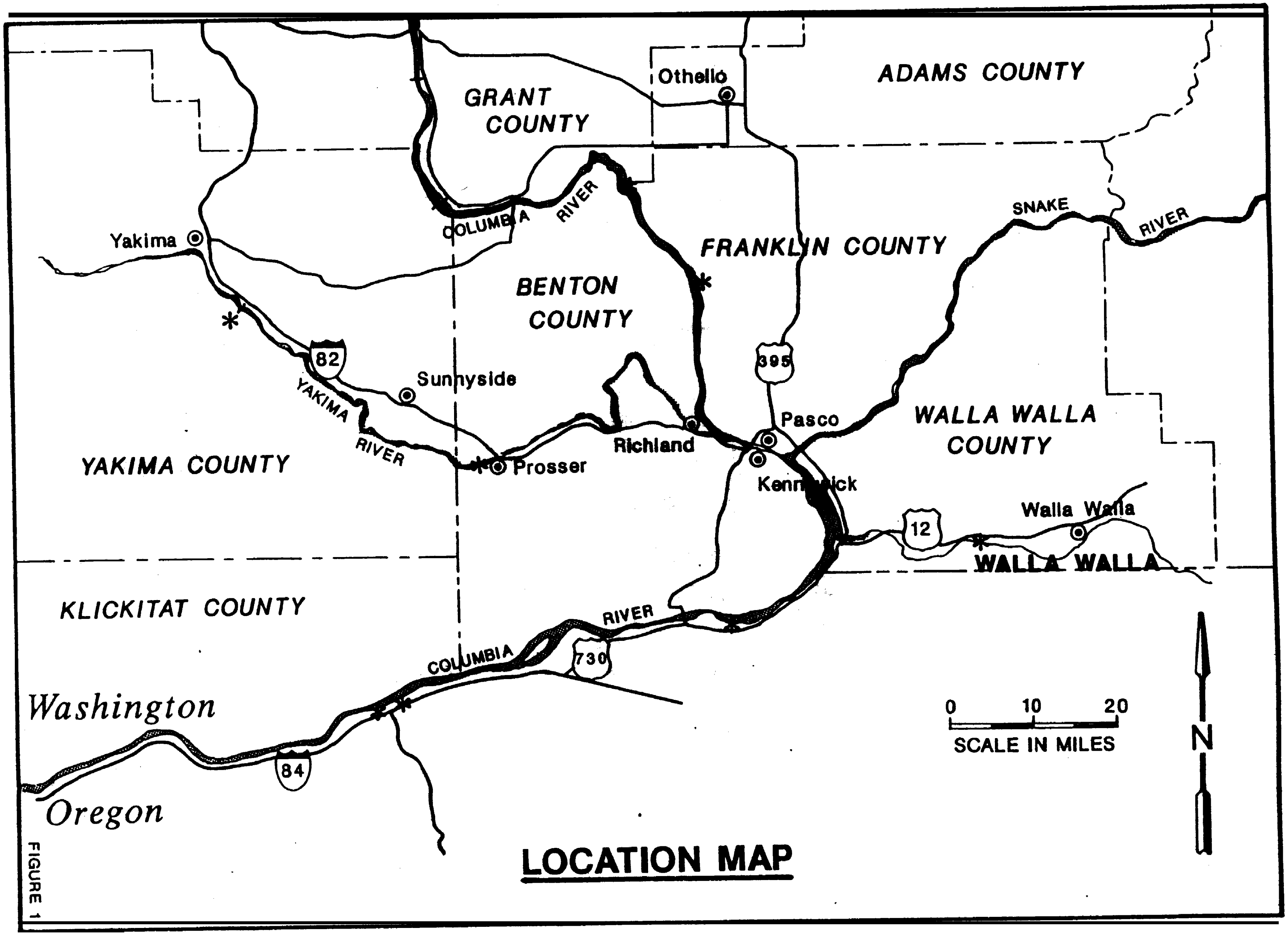
| | Steelhead Pond | Oxbow Pond |
|---|---|---|
| Steelhead Pond Imps. | **$ 80,000** | |
| Oxbow Pond Imps. | - | **$118,900** |
| River Water Pump Station | - | **125,800** |
| Ground Water Well | - | **87,200** |
| Portable Freezer Van* | **41,500** | **41,500** |
| Standby Generator | - | **48,300** |
| Motor Starters/Switch Gear | | **19,200** |
| Adult Capture | - | **45,100** |
| Electric Utility | **1,000** | **11,800** |
| Telephone Utility | **2,500** | **2,500** |
| Subtotal | **125,000** | **500,300** |
| 15% Contingency | **18,800** | **75,000** |
| Total | **$143,800** | **$575,300** |
| Monthly Power Cost | **358** | **7,700** |

* Food Freezer/Prep. Building Alternative Cost = **$48,900**

## VI ADVANTAGES AND DISADVANTAGES

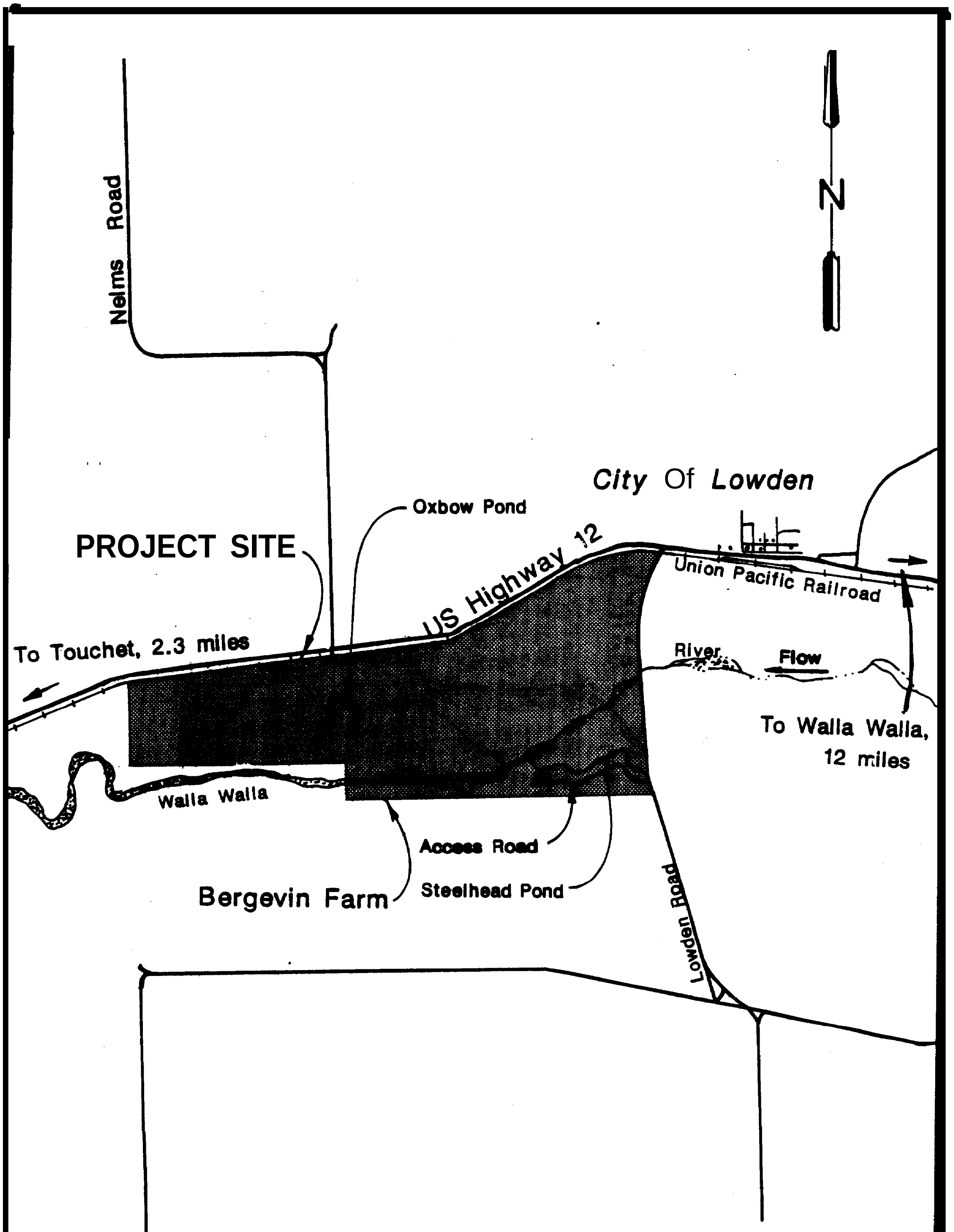
The Walla Walla site has the following advantages and disadvantages:

- River and well water must be pumped to oxbow pond.
- Quantity of ground water for steelhead pond probably inadequate.
- Land is privately owned.
- Natural pond rearing is difficult to manage.
- Potential fish health problems.
- Security would be difficult.




LOCATION MAP

FIGURE 1

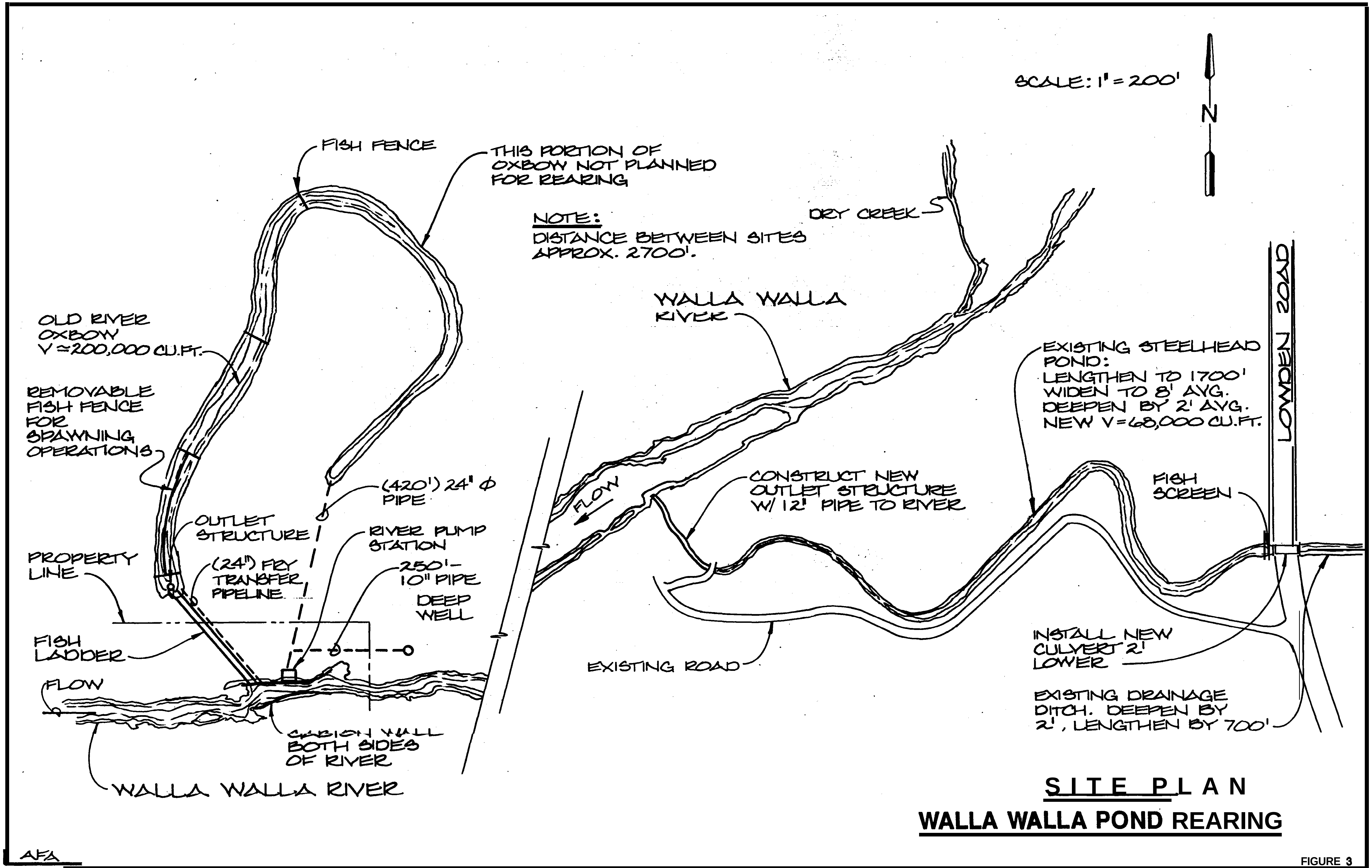



**VICINITY MAP**

**WALLA WALLA**

SCALE:1"=2000'

FIGURE 2




SITE PLAN

WALLA WALLA POND REARING

FIGURE 3

# APPENDIX A

# CORRESPONDENCE

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 21, 1987

Pacific Power and Light Co.
27 North 2nd Street
Walla Walla, Washington 99362

Attention: Mr. Norris Mulkey

Gentlemen:

Subject: Power Service
Walla Walla Acclimation

This is to inquire about the availability and cost for power service to a site on the Bergevin Ranch, just south of Lowden, Washington. The project area is shown on the enclosed drawing.

Sverdrup is performing a chinook salmon fry rearing feasibility study for the U.S. Fish & Wildlife Service and this site is one of several being considered. The power requirement is approximately 350 horsepower for pumping, 3 horsepower for a fish food freezer and probably a 200 amp service for a residence and low level outdoor lighting. This facility would only operate during May and for six to eight weeks in October and November.

At your earliest convenience, please send me a letter that gives an approximate cost for providing this electric service. Also, please include your power rates so that we can estimate operational costs.

Please let me know if you have questions. Thank you for your assistance.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen, P.E.

Enclosure

PACIFIC POWER
**Inland** Empire Division Walla Walla • Sandpoint
27 N. Second Avenue • P 0 Box 607 • Walla Walla. Washington 99362 • (509) 525-2340

RECEIVED
JUN 24 1987
SVERDRUP CORP.
SEATTLE OFFICE

June 19, 1987

Sverdrup Corporation
Harold T. Andersen, P.E
1200 112th Avenue, N.E.
Suite C 143
P.O.Box 369
Bellevue, Washington 98009

Subject: Power Service
Walla Walla Acclimation

Dear Mr. Anderson,

This is in response to your inquiry regarding availability and cost for electrical service to-a site on the Bergevin Ranch, Lowden, Washington.

Pacific would provide 480Y/277V, 3 phase, 4 wire service to a load of l-320 HP. and l-30 H.P. pump motors. Pacific would require the 320 H.P. motor to be Code G or better and have reduced voltage starting with an autotransformer set on the 65% tap. These requirements are based on an assumption the motor would not start more than 6 times a hour.

Pacific's present line extension policy allows for transformers, meter, service and 300' of primary conductor as free extension. Preliminary estimate requires a cash advance of $11,750.00 to provide service to site. Also, a monthly minimum may be required for a term of three (3) years.

Enclosed are copies of Pacific's rate schedules 24 and 36. We will need to know hours of operation before we could prepare a cost analysis to determine which rate schedule would be in your best interest.

Please let me know if you have questions regarding this matter or we may be of further assistance.

Sincerely,

Norris A. Mulkey

Norris A. Mulkey
District Operations Manager

Enclosure

PACIFIC POWER & LIGHT COMPANY

For Commission's Receipt Stamp

SCHEDULE 24
GENERAL SERVICE

AVAILABLE:
In all territory served by Company in the State of Washington.

APPLICABLE:
To non-residential customers whose entire requirements (including or excluding water heating) are supplied hereunder. Deliveries at more than one point, or more than one voltage and phase classification, will be separately metered and billed.

Emergency, Frost Protection, and Remote Service will be furnished by contract in accordance with Rule 2.(a) of this tariff.

This schedule is not applicable to standby or breakdown service.

MONTHLY BILLING:
The Monthly Billing shall be the sum of the Basic, Demand, Energy, and Reactive Power Charges:

BASIC CHARGE:

| If Load Size* Is: | The Monthly Basic Charge* Is: Single Phase | Three Phase |
|---|---|---|
| 10 kw or less | $3.75 | $5.50 |
| Over 10 kw | $3.75 plus $.50 per kw for each kw in excess of 10 kw. | $5.50 plus $.50 per kw for each kw in excess of 10 kw. |

*Note: Kw load size, for the determination of the Basic Charge, shall be the average of the two greatest non-zero monthly demands established any time during the 12-month period which includes and ends with the current billing month.

ENERGY CHARGE:

| Winter | Summer | |
|---|---|---|
| 7.850¢ | 7.137¢ | Per kwh for the first 85 kwh per kw of demand but for not less than the first 1,000 kwh. |
| 5.064¢ | 4.604¢ | Per kwh for the next 8,000 kwh. |
| 4.251¢ | 4.251¢ | Per kwh for all additional kwh. |

(Continued)

Issued March 2, 1987 Effective March 19, 1987

Issued by PACIFIC POKER 6 LIGHT COMPANY

By Fredric D. Reed Title Senior Vice President

TF2 24.1E

Form F

PACIFIC POWER & LIGHT COMPANY

For Commission's Receipt Stamp

SCHEDULE 24
(Continued)
GENERAL SERVICE

SEASONAL DEFINITION:
Winter months are defined as the six regular billing months November through April. Summer months are defined as the six regular billing periods May through October. In 1987 the summer and winter months will begin with regularly scheduled meter readings on April 28, 1987, and October 28, 1987, respectively.

MINIMUM CHARGE:
The monthly minimum charge shall be the Basic Charge. A higher minimum may be required under contract to cover special conditions,

REACTIVE POWER CHARGE:
The maximum 30-minute reactive demand for the month in kilovolt amperes in excess of 40% of the kilowatt demand for the same month will be billed, in addition to the above charges, at 45¢ per kvar of such excess reactive demand.

DEMAND:
The kw shown by or computed from the readings of Company's demand meter for the 30-minute period of the customer's greatest use during the month determined to the nearest kw.

CONTINUING SERVICE:
Except as specifically provided otherwise, the rates of this tariff are based on continuing service at each service location. Disconnect and reconnect. transactions shall not operate to relieve a seasonal customer from monthly minimum charges.

RULES AND REGULATIONS:
Service under this schedule is subject to the General Rules and Regulations contained in the tariff of which this schedule is a part and to those prescribed by regulatory authorities.

Issued February 20, 1987 Effective March 23, 1987

Issued by PACIFIC POWER & LIGHT COMPANY

By Fredric D. Reed Title Senior Vice President

TF2 24.2E

Form F

PACIFIC POWER & LIGHT COMPANY

For Commission's Receipt Stamp

SCHEDULE 36
LARGE GENERAL SERVICE - OPTIONAL
LESS THAN 1,000 KW

AVAILABLE:

In all territory served by Company in the State of Washington.

APPLICABLE:

To non-residential customers with electric service loads which have not exceeded 999 kw in more than one month of any consecutive 18-month period. Deliveries at more than one point, or more than one voltage and phase classification, will be separately metered and billed.

This schedule is not applicable to standby or breakdown service or where service is seasonally disconnected during any one-year period.

Partial requirements service for loads of less than 1,000 kw will be provided only by application of the provisions of schedule 33.

MONTHLY BILLING:

The Monthly Billing shall be the sum of the Basic, Demand, Energy, and Reactive Power Charges; plus applicable Metering and Delivery Adjustments.

Basic Charge:

| If Load Size* Is: | The Monthly Basic Charge+ Is: |
|---|---|
| 100 kw or less | $155 |
| 101 kw - 300 kw | $ 55 plus $1.00 per kw |
| Over 300 kw | $115 plus $.80 per kw |

*Note: Kw load size, for the determination of the Basic Charge, shall be the average of the two greatest non-zero monthly demands established any time during the 12-month period which includes and ends with the current billing month.

| Demand Charge: | Winter | Summer |
|---|---|---|
| For each kw of Billing Demand | $1.69 | $1.13 |

Energy Charge: 4.040¢ per kwh for the first 40,000 kwh
3.708¢ per kwh for all additional kwh

SEASONAL DEFINITION:

Winter months are defined as the six regular billing periods November through April. Summer months are defined as the six regular billing periods May through October. In 1987 the summer and winter months will begin with regularly scheduled meter readings on April 28, 1987, and October 28, 1987, respectively.

Issued March 2, 1987 Effective March 19, 1987

Issued by PACIFIC POWER & LIGHT COMPANY

By Fredric D. Reed Title Senior Vice President

TF2 36.1E

Form F

PACIFIC POWER & LIGHT COMPANY

For Commission's Receipt Stamp

SCHEDULE 36
(Continued)
LARGE GENERAL SERVICE - OPTIONAL
LESS THAN 1,000 KW

MINIMUM CHARGE:

The monthly minimum charge shall be the Basic Charge plus the Demand Charge. A higher minimum may be required under contract to cover special conditions. C C

REACTIVE POWER CHARGE:

The maximum 30-minute reactive demand for the month in kilovolt amperes in excess of 40% of the kilowatt demand for the same month will be billed, in addition to the above charges, at 45¢ per kvar of such excess reactive demand.

PRIMARY VOLTAGE METERING AND DELIVERY ADJUSTMENTS:

The above monthly charges are applicable without adjustment for voltage when delivery and metering are at Company's standard secondary voltage.

Metering: For so long as metering voltage is at Company's available primary distribution voltage of 11 kv or greater, the above charges will be reduced by 1.0%.

Delivery: For so long as delivery voltage is at Company's available primary distribution voltage of 11 kv or greater, the total of the above charges will be reduced by 30¢ per kw of load size used for the determination of the Basic Charge billed in the month. A High Voltage Charge of $60 per month will be added where such deliveries are metered at the delivery voltage.

The reductions of charges herein shall not operate, to reduce the minimum charge,

When a new delivery or an increase in capacity for an existing delivery is, at request of customer, made by means of Company-owned transformers at a voltage other than a locally standard distribution voltage, the above charges for any month will be increased by 30¢ per kw of load size used for the determination of the Basic Charge billed in the month.

(Continued)

"By Authority of Order of the W.U.T.C., Cause No. U-84-65"

Issued August 6, 1985 Effective August 14, 1985

Issued by PACIFIC POWER & LIGHT COMPANY

By Fredric D. Reed Title Vice President

TF2 36.2E

Form F

PACIFIC POWER & LIGHT COMPANY

For Commission's Receipt Stamp

SCHEDULE 36
(Continued)
LARGE GENERAL SERVICE - OPTIONAL
LESS THAN 1,000 KW

PRIMARY VOLTAGE METERING AND DELIVERY ADJUSTMENTS: (Continued)

Company retains the right to change its line voltage or classifications thereof at any time, and after reasonable advance notice to any customer affected by such change, such customer then has the option to take service at the new line voltage or to accept service through transformers to be supplied by Company subject to the voltage adjustments above.

DEMAND:

The kw shown by or computed from the readings of Company's demand meter for the 30-minute period of the customer's greatest use during the month, determined to the nearest kw, but not less than 100 kw. C

CONTINUING SERVICE:

Except as specifically provided otherwise, the rates of this tariff are based on continuing service at each service location. Disconnect and reconnect transactions shall not operate to relieve a seasonal customer from monthly monthly minimum charges.

RULES AND REGULATIONS:

Service under this schedule is subject to the General Rules and Regulations contained in the tariff of which this schedule is a part and to those prescribed by regulatory authorities.

"By Authority of Order of the W.U.T.C., Cause V-84-65"

Issued August 6, 1985 Effective August 14, 1985

Issued by PACIFIC POWER & LIGHT COMPANY

By Fredric D. Reed Title Vice President

TF236.3E

Form F

Sverdrup
CORPORATION

1200 112th Avenue, N.E.
Suite C 143
P.O. Box 369
Bellevue, Washington 98009

206 454-9562

May 21, 1987

Pacific Northwest Bell
601 West Main Street
Room 600
Spokane, Washington 99201

Attention: Ms. Pat Skaer

Dear Ms. Skaer:

Subject: Walla Walla Phone Service

Thank you for the information regarding telephone service to our project in Walla Walla.

As I mentioned, we are doing a chinook salmon fry rearing feasibility study for the U.S. Fish & Wildlife Service. Part of the project has to do with costs and, therefore, we need to know your charges for providing service to our site. It needs to be a single line to an employee residence/office trailer. The location is shown on the enclosed map.

At your earliest convenience, please send me a letter that gives an approximate cost for installation of the required phone lines and appurtenances. Also, please let me know if you have questions.

Again, thank you for your assistance.

Very truly yours,

SVERDRUP CORPORATION

Harold Andersen

Harold T. Andersen

Enclosure

Pacific Northwest Bell
A US WEST COMPANY

May 29, 1987

Sverdrup Corporation
Attn: Mr. Harold T. Anderson
1200 112th Avenue, N.E.
Suite C-143
P. O. Box 369
Bellevue, Washington 98009

Dear Mr. Anderson:

I'm writing regarding your request for 'the cost to provide telephone service in Walla Walla at a tentative fish hatchery site.

The following information is not firm until an order is placed and an engineer formally visits the site. The location you indicated is in the Walla Walla exchange with a legal description of: NW 1/4 of the NE 1/4 of Section 31, Township 7, Range 34.

Per our engineer for that area, the cost to run line to the site depends on your choice of access. If you access the location from the east-west road running through Section 31, the line extension cost would be approximately $1,200.00. If you access the location from the north-south road running through Section 32, the approximate cost would be $2,400.00.

In addition, there would be a minimum service connection charge, which differs between residential and commercial accounts. The use of this service would probably be classified as commercial. The service connection charge for commercial service is $48.00 per line, not including inside wiring and jacks. The monthly rate for one commercial line, single party service, will be about $58.00.

If I can be of further assistance please call me on 509-455-2547.

Sincerely,

Pat Skaer

PAT SKAER
Service Representative
Customer Services Marketing

russ
bergevin
inc.
specialist in
GRAIN
&
LIVESTOCK
HEDGING
(509) 525-7005

Harold Anderson
c/o Sverdrup So.
1200 112th AVE NE
P.O. Box 369
Bellevue, WA 98009

June 23, 1987

R.E.: Bergevin Ranch Pond

Dear Harold,

Gary was there the other day checking on pumping sites out of the Walla Walla River and it occurred to me that you should include the enclosed material with your report.

Point #(l) is located at the large cottonwood tree 1/4 mile up-river from the swinging bridge.

Point #(2) is located on the N. side of the river across from the W. end of the long slender alfalfa field.

Congratulations on your recent marriage. I thouqht I could detect a small smile on your face the last time I was over, but passed it up as a gas pain.

Sincerely,

Russ Bergevin

Encl: 2
em

RUSS BERGEVIN WATER RIGHTS
June 1983

14 acre8 .......... Filed 1953
Cert. #11, Page 5323, Permit #8974
14 Acre slough & spring branch - (Steelhead Pond)

40acres ......... 1952
Vol. 12 Page 5813, Permit #8975

50 acres ......... 1974
Cert. #S3-22301C, Holstein Hill D. Ditch

71 acres ........ 1870
Claim 616 6 616A in State-vs-Ackerman cause 19075.
Transferred from Old Lowden Ditch to pump from river.

100 acre8 ........ 1941
Cert. # 3550
Transferred from Old Lowden Ditch to pump from river.

40 acre6 ......... 1953
Book #25 of permits, page 8975
app. 1191 7
Transferred from Old Lowden Ditch to pump from river.

2 Wells:

50 acres ........ 03 25299B, Cert. 8 G3-25299G
Holstein Hill
180 GPM

15 acres ........ G3-25281B
@ Steelhead Pond

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

CERTIFICATE OF CHANGE UNDER SURFACE WATER CERTIFICATE NO. 94 (WALLA WALLA RIVER ADJUDICATION) AND CERTIFICATE OF CHANGE NOS. 196 AND251

8407367

In accordance with the provisions of Chapter 117, Laws ofWashington for 1917, and the regulations of the Department of Ecology.

THIS IS TO CERTIFY that Russell F. Bergevin of Walla Walla, Washington has complied with all of the requirements of the Revised Code of Washington 90.03.280 and the rules and regulations of the Department of Ecology, and is hereby granted the right to change the place of use and add two (2) points of diversion as follows:

Add two (2) additional points of diversion at points located approximately (1) 281 feet north and 12 feet west from the SE corner of Sec. 30 and (2) 134 feet south and 610 feet east from the N¼ corner of Sec. 31; ALL WITHIN T. 7 N., R. 34 E.W.M. to divert 0.533 cubic feet per second from April 1 to July 1, and 0.40 cubic feet per second from July 1 to October 1 (Change 196); 0.133 cubic feet per second from April 1 to July 1, and 0.10 cubic feet per second from July 1 to October 1 (Change 251). A total of 0.633 cubic feet per second from April 1 to July 1, and 0.50 cubic feet per second from July 1 to October 1, may be diverted from the Walla Walla River for the irrigation of 50 acres within the following described lands:

Beginning at a point in the east line of the W½SW¼ of Sec. 29, T. 7 N., R. 34 E.W.M., which point is 1320.34 feet west and 1506.0 feet south of the center of said Sec. 29; and running thence south 53°57' west 1313.54 feet; thence north 20°10' east 1340.0 feet; thence north 107.0 feet; thence south 77°08' west 980.6 feet; thence north 12°08' west 472.6 feet more or less to the southerly line of the right of way of the Oregon-Washington Railroad and Navigation Company; thence southwesterly along the southerly line of said right of way to the point of intersection thereof with the west line of Sec. 30; thence south along the west line of said Sec. 30 which is about 2689.3 feet north of the W¼ corner of Sec. 31; thence south 87°36'5" east 2516.51 feet to a point on the north south center line of Sec. 31; thence 89°11" east a distance of 600 feet; thence south 191.44 feet; thence north 89°20'19" east 969.07 feet; thence south 234 feet; thence east along a line parallel to and 444.18 feet south of the north line of Sec. 31; thence north along the east line of Sec. 31 to the NE corner of Sec. 31; thence east along the Section line common to Sec. 29 and 32 a distance of 1320 feet to the SE corner of the W½SW¼ of Sec. 29; thence north along the east line of the W½SW¼ of said Sec. 29, 1134.0 feet more or less to the point of beginning; ALL IN T. 7 N., R. 34 E.W.M., Walla Walla County, Washington.

That this change is authorized subject to the following provisions:

"At such time that the Department of Ecology determines that regulation and management of the subject waters is necessary and in the public interest, an approved measuring device shall be installed and maintained in accordance with RCW 90.03.360 or WAC 508-64-020 through WAC 508-64-040."

"A measuring device approved by the Department of Ecology may be required at the present point of diversion which is located in the NE¼ of Sec. 32, T. 7 N., R. 35 E.W.M. to insure that waters passed to the applicant during periods of regulation do not exceed the applicant's rights. Because this requirement may cause the installation and removal of the measuring device each year, the applicant shall request permission from the Department of Ecology prior to installing or removing the measuring device."

"The applicant will not be allowed to divert water at the two (2) additional points of diversion and at the existing point of diversion (Old Lowden Ditch) at the same time. The two (2) new points of diversion are to be used instead of, and not in conjunction with, the present point of diversion. Should the applicant desire to divert his waters at the present point. of diversion (Old Lowden Ditch) he shall request permission from the Department of Ecology and shall not divert any waters until approval is granted by the Department of Ecology.

GIVEN UNDER MY HAND AND SEAL of this office at Spokane, Washington this 12th day of October, 1984.

FILED FOR RECORD IN WALLA WALLA CO. WASH.
BY State of Wa
OCT 26 10 44 AM '84
G. LYNN SMITH
AUDITOR

DONALD W. MOOS, Director
Department of Ecology

by John L. Arnquist
JOHN L. ARNQUIST, Regional Manager

RECORDED:

VOL. l-3, PP. 414

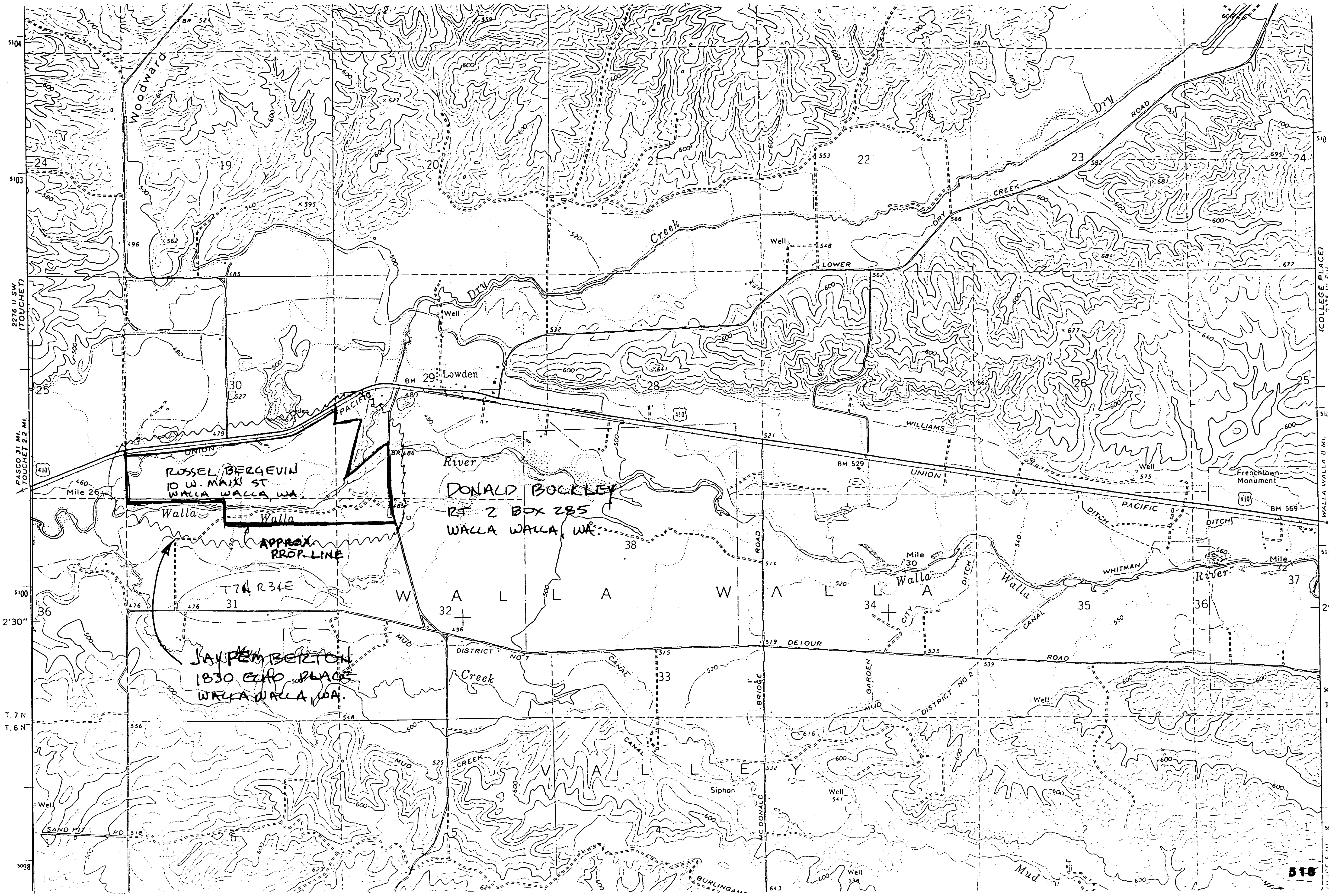
CERTS. OF CHANGE



VOL 146 PAGE 1241

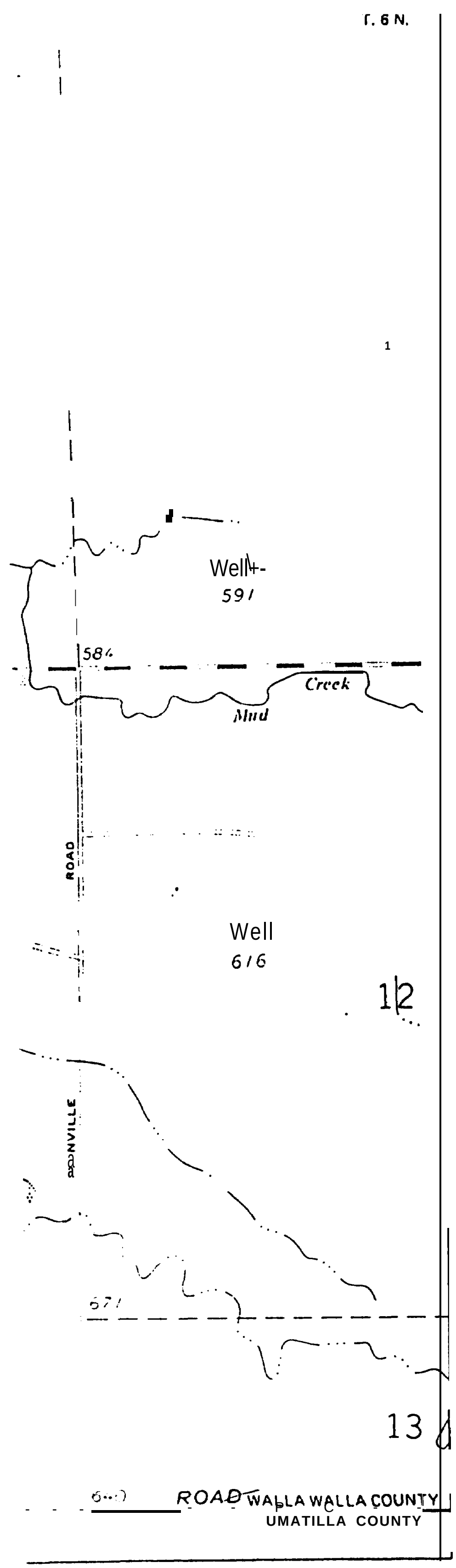
# APPENDIX B

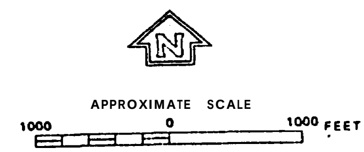
# LAND OWNERSHIP INFORMATION


RUSSEL BERGEVIN
10 W. MAIN ST
WALLA WALLA, WA
DONALD BUCKLEY
RT 2 BOX 285
WALLA WALLA, WA.
APPROX PROP LINE
T7N R34E
JAY PEMBERTON
WALLA WALLA, WA.
Woodward
Dry Creek
Lowden
UNION PACIFIC
Walla Walla River
LOWER DRY CREEK ROAD
WILLIAMS
Frenchtown Monument
WHITMAN DITCH
CITY DITCH
CANAL
DETOUR ROAD
MUD CREEK
DISTRICT NO 7
DISTRICT NO 2
GARDEN
BRIDGE ROAD
MC DONALD
Siphon
SAND PIT RD
BURLINGAME
W A L L A   W A L L A
V A L L E Y
T. 7 N
T. 6 N
2276 II SW (TOUCHET)
(COLLEGE PLACE)
PASCO 31 MI. TOUCHET 2.2 MI.
WALLA WALLA 8 MI.

# APPENDIX C

## FLOW RECORDS, FLOOD PREDICTIONS




NATIONAL FLOOD INSURANCE PROGRAM

# FLOODWAY

## FLOOD BOUNDARY AND FLOODWAY MAP

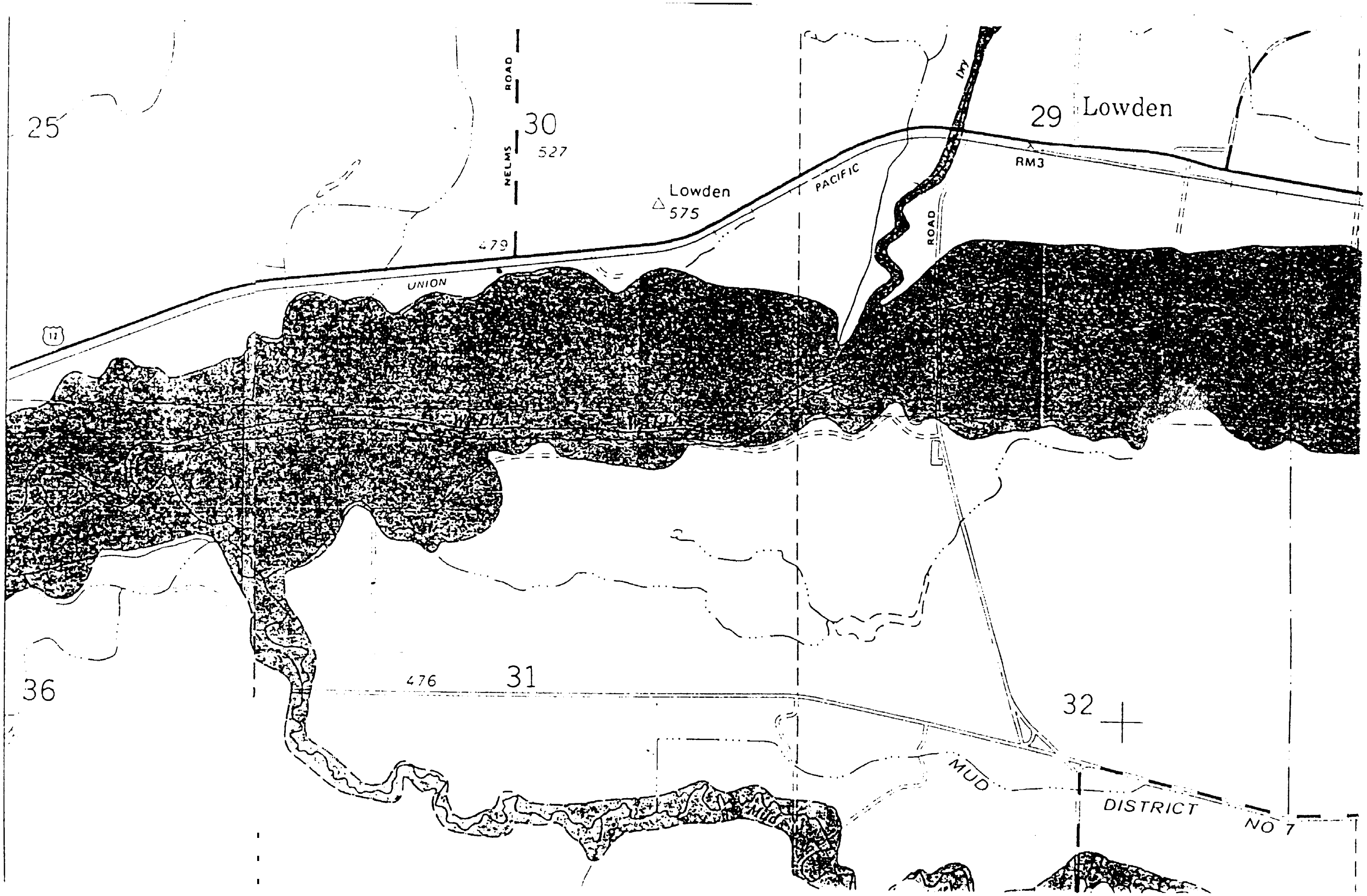
## WALLA WALLA COUNTY, WASHINGTON
(UNINCORPORATED AREAS)

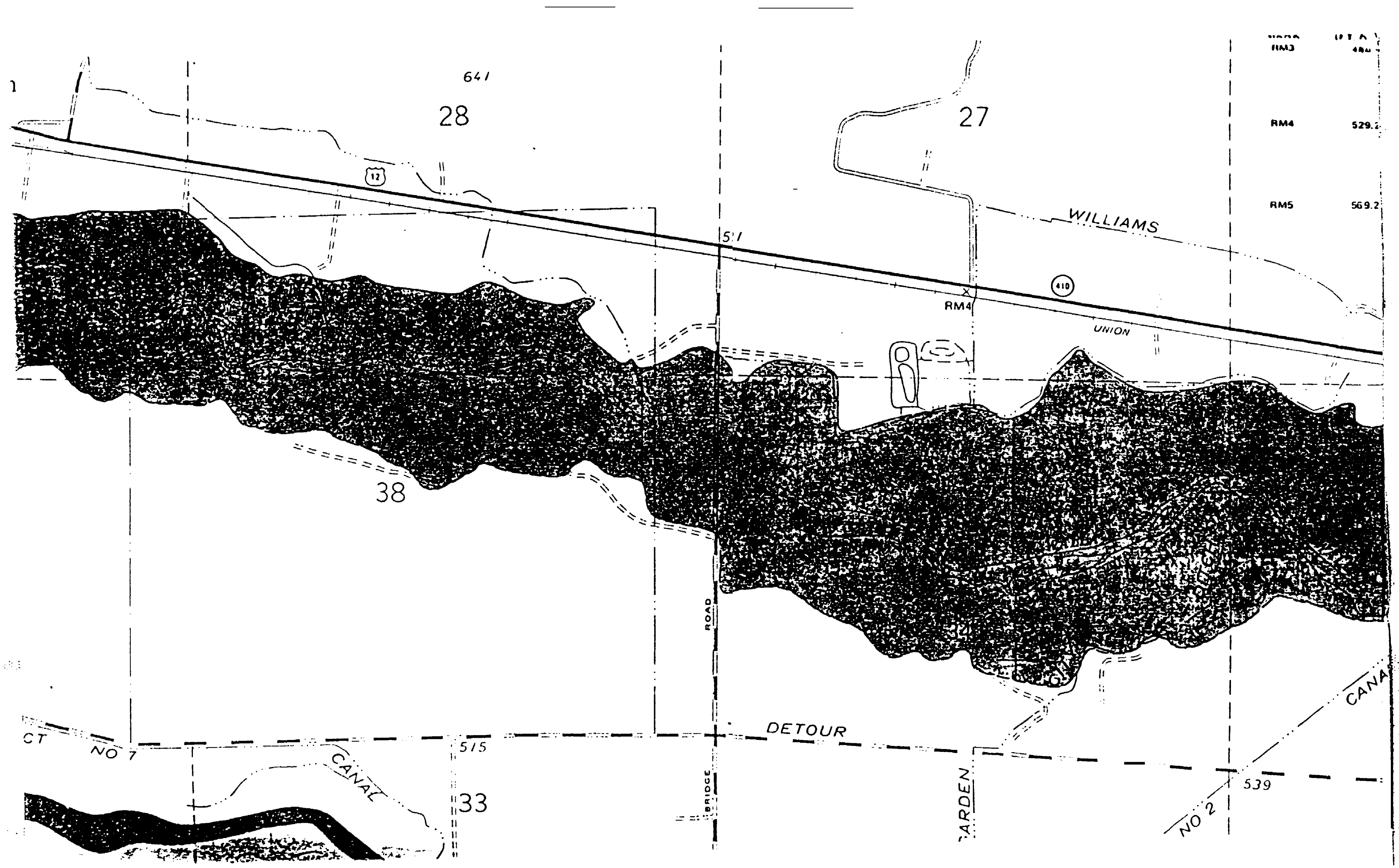
PANEL 420 OF 500
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
530194 0420

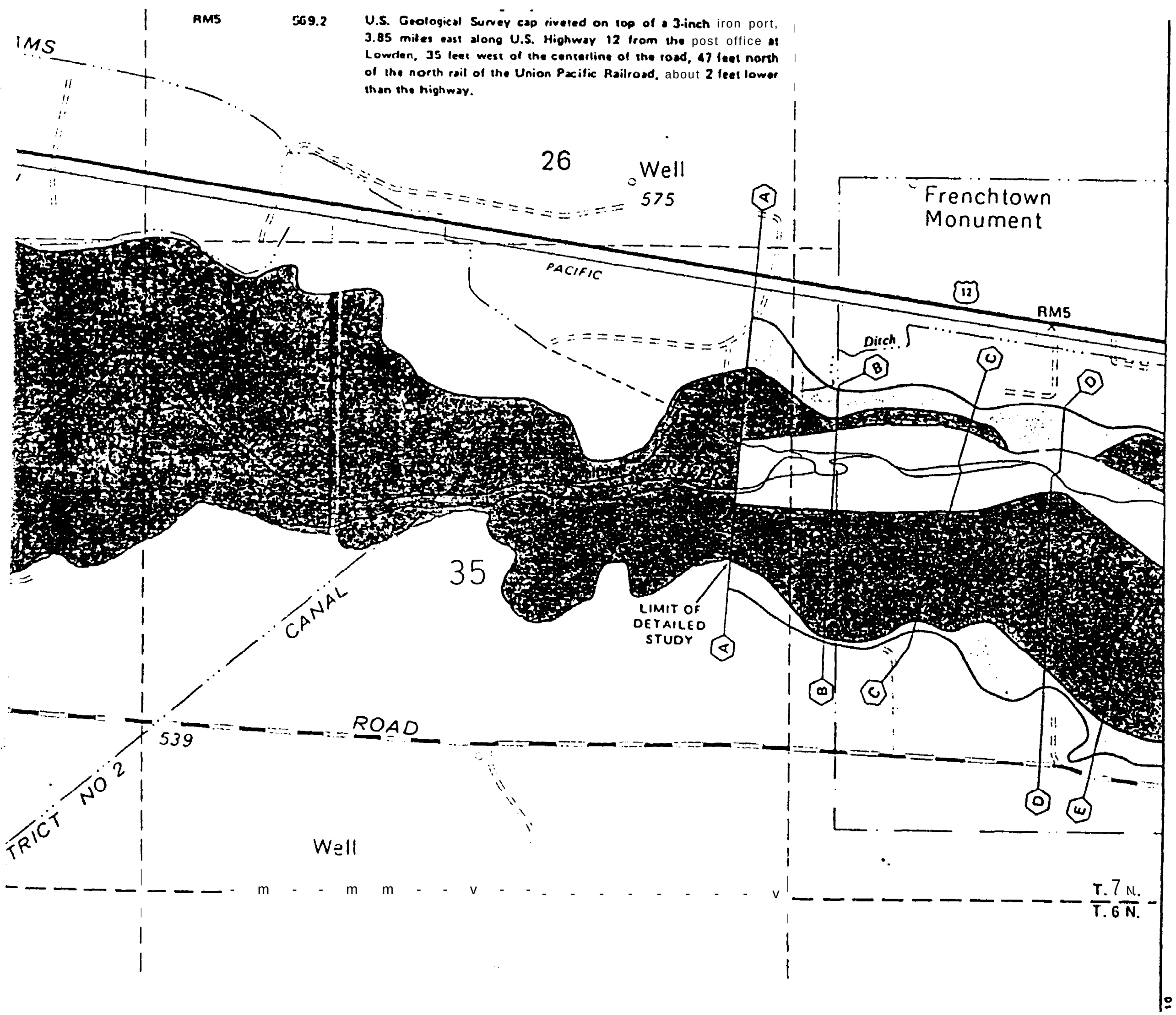
EFFECTIVE DATE:
DECEMBER 1, 1983

Federal Emergency Management Agency


25
30
527
NELMS
ROAD
Lowden
575
479
UNION
PACIFIC
29
Lowden
RM3
ROAD
36
476
31
32
MUD
DISTRICT
NO 7



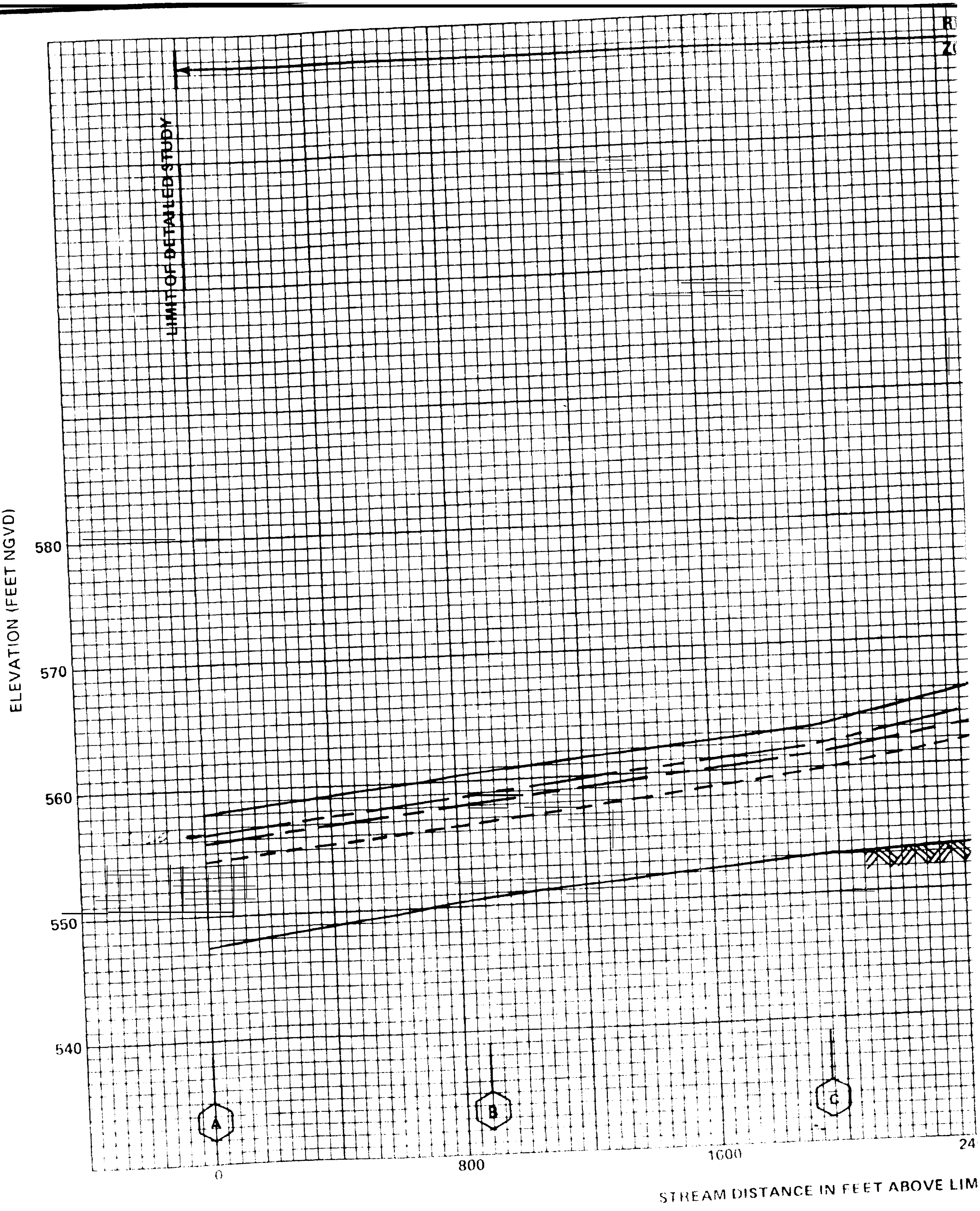
641
28
27
RM3
RM4
529.2
RM5
569.2
12
WILLIAMS
51
410
RM4
UNION
38
ROAD
BRIDGE
DETOUR
CT
NO 7
CANAL
515
33
ARDEN
539
NO 2
CANA

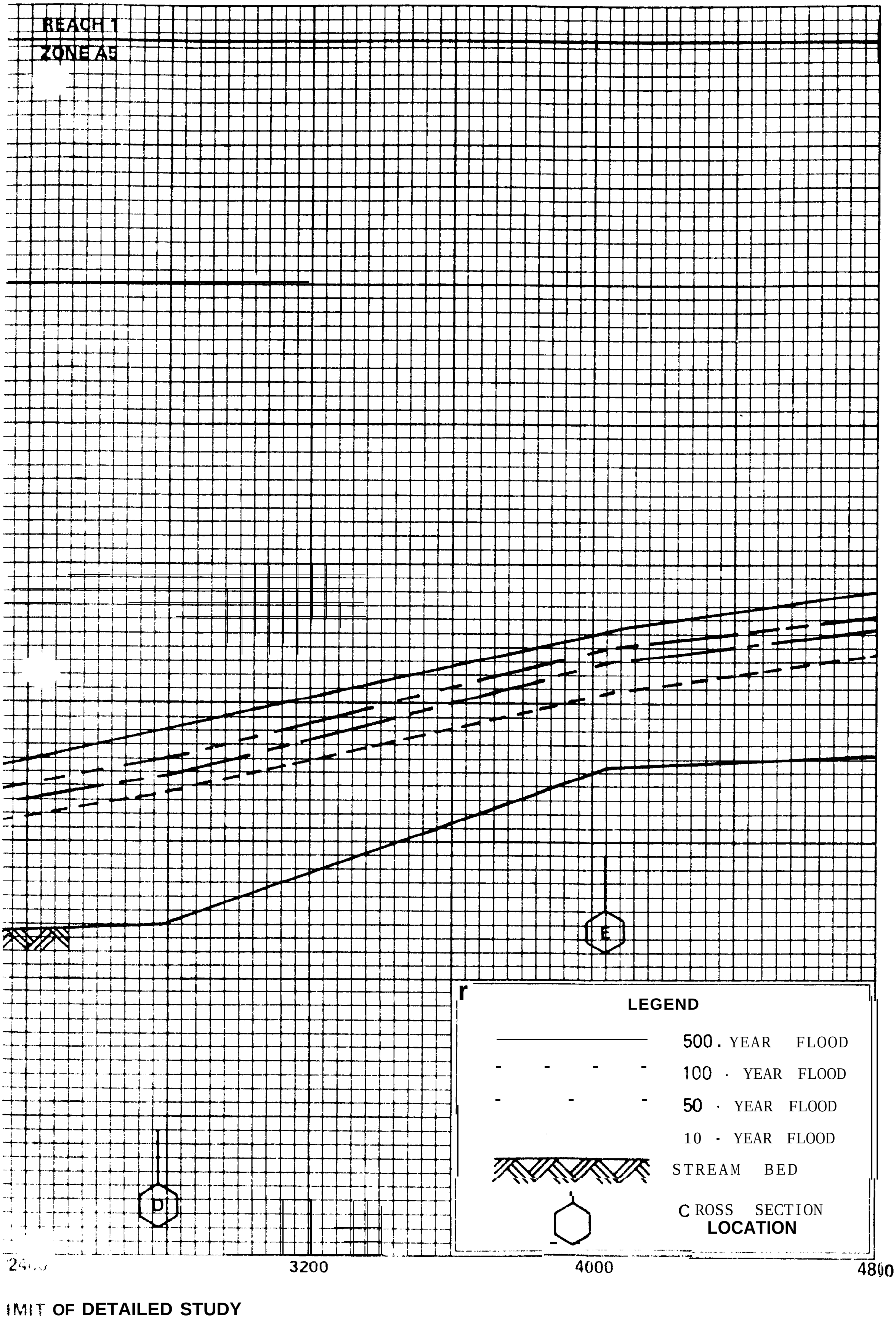



This map was prepared to facilitate flood plain management activities only; it may not show all special flood hazard areas in the community or all planimetric features outside of the flood plain. Refer to the latest official Flood Insurance Rate Map for any additional areas of special flood hazard.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

For adjoining map panels, see separately printed Index to Map Panels.


LIMIT OF DETAILED STUDY
ELEVATION (FEET NGVD)
580
570
560
550
540
A
B
C
0
800
1600
24
STREAM DISTANCE IN FEET ABOVE LIM




FLOOD PROFILES

WALLA WALLA RIVER (NEAR COLLEGE PLACE)

FEDERAL EMERGENCY MANAGEMENT AGENCY

WALLA WALLA COUNTY, WA
(UNINCORPORATED AREAS)

07P

| [illegible] | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NGVD) | | | |
| Walla Walla River (Near College Place) | | | | | | | | |
| A | 0 | 550 | 3,208 | 5.6 | 556.5 | 556.5 | 557.5 | 1.0 |
| B | a75 | 690 | 3,552 | 5.1 | 559.0 | 559.0 | 559.6 | 0.6 |
| C | 1,950 | 708 | 3,965 | 6.1 | 561.9 | 561.9 | 562.6 | 0.7 |
| D | 2,770 | 384 | 1,979 | 9.1 | 565.9 | 565.9 | 566.1 | 0.2 |
| E | 4,040 | 591 | 2,504 | 7.2 | 573.9 | 573.9 | 573.9 | 0.0 |
| F | 5,245 | 512 | 3,192 | 5.6 | 577.5 | 577.5 | 578.2 | 0.7 |
| G | 6,210 | 781 | 2,524 | 7.1 | 582.9 | 582.9 | 583.1 | 0.2 |
| H | 7,200 | 415 | 4,472 | 4.0 | 587.4 | 587.4 | 588.2 | 0.8 |
| I | 9,580 | 515 | 1,768 | 10.2 | 592.0 | 592.0 | 592.7 | 0.7 |
| J | 11,630 | 353 | 1,491 | 9.8 | 602.7 | 602.7 | 602.8 | 0.1 |
| K | 12,550 | 397 | 2,095 | 7.0 | 607.7 | 607.7 | 608.6 | 0.9 |
| L | 13,315 | 890 | 3,344 | 4.4 | 612.2 | 612.2 | 612.6 | 0.4 |
| M | 14,490 | 849 | 1,575 | 9.3 | 618.2 | 618.2 | 618.2 | 0.0 |
| N | 16,825 | 302 | 2,235 | 6.5 | 627.3 | 627.3 | 628.0 | 0.7 |
| O | 18,855 | 247 | 1,452 | 10.1 | 634.9 | 634.9 | 634.9 | 0.0 |
| P | 19,570 | 224 | 1,366 | 10.7 | 640.2 | 640.2 | 640.2 | 0.0 |
| Q | 20,215 | 568 | 3,570 | 4.1 | 644.9 | 644.9 | 645.2 | 0.3 |
| R | 21,390 | 402 | 1,359 | 10.7 | 649.0 | 649.0 | 649.1 | 0.1 |
| S | 23,625 | 551 | 2,675 | 5.5 | 661.5 | 661.5 | 662.0 | 0.5 |
| T | 26,070 | 944 | 2,416 | 6.0 | 670.7 | 670.7 | 671.6 | 0.9 |
| U | 27,305 | 800 | 2,439 | 6.0 | 678.4 | 678.4 | 679.0 | 0.6 |
| V | 27,845 | 600 | 3,688 | 4.0 | 684.7 | 684.7 | 684.7 | 0.0 |
| W | 28,530 | 479 | 1,711 | a.5 | 685.5 | 685.5 | 686.2 | 0.7 |
| X | 29,380 | 447 | 2,502 | 5.8 | 689.9 | 689.9 | 690.8 | 0.9 |
| Y | 31,120 | 397 | 1,783 | 8.2 | 696.7 | 696.7 | 697.3 | 0.6 |

[1] Feet Above Limit of Detailed Study



TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

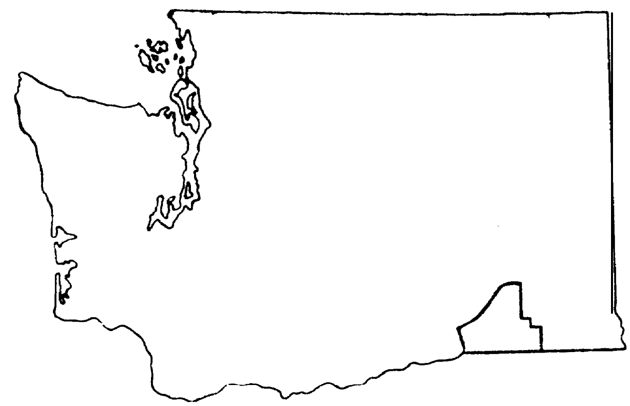
WALLA WALLA COUNTY, WA
(UNINCORPORATED AREAS)

**FLOODWAY DATA**

WALLA WALLLA RIVER (NEAR COLLEGE PLACE)

# FLOOD INSURANCE STUDY

## WALLA WALLA COUNTY, WASHINGTON
### UNINCORPORATED AREAS



JUNE 1, 1983

Federal Emergency Management Agency

COMMUNITY NUMBER - 530194

An improved channel exists from below the mill creek diversion Dam and through Walla Wala to Gose Street. From Roosevelt Street to Mullan Avenue This channel is paved with concrete. The improved channel through Walla Walla is designed to pass 5,400 cfs with some freeboard. Therefore, all flood flows except extremely rare floods could be carried within the improved channel (Reference 4).

In addition to protection from floods on Mill Creek through Walla Walla, the storage reservoir and improved channel afford relief from floods in upper Yellowhawk Creek and on Garrison Creek, and partial reduction of floods on lower Yellowhawk Creek and lower Mill Creek.

Local levees have been built along Mill Creek by farmers to afford flood protection and to stabilize the stream banks. Some channel clearing was done following the December 1964 and January 1965 floods. Private levees have also been constructed in a few places along Lower Russell and Yellowhawk Creeks., None of these levees provide adequate protection against large floods (Reference 4).

Flood damage prevention measures on other stream.'; arc limited to those constructed by local interests or by Federal agencies under emergency conditions. They consist of channel clearing and emergency levee construction and are not considered permanent nor adequate to protect against a 100-year event.

The National Weather Service provides flash flood forecasts and warnings under its Flash Flood Alert, Watch and Warning Program. Walla Walla County, in cooperation with the National Weather Service and Defense Civil Preparedness Aqency, has established a Flash Flood Alarm System and Warning Plan.

## 3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

## 3.1 Hydrolog ic Analyses

Hydrologic analyses were carried out to establish the peak dishcarge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the county.

U.S. Geological Survey gaging stations located on streams in Walla Walla County and in nearby drainage areas having similar hydrologic characteristics were the principal source of data used for defining the frequency-discharge relationship for al1 streams studied. Gaging stations on streams in Walla Walla County are: Walla Walla River near 'l'ouchet (1 9S2 to 1977) , Touchet River near Bolles (l952 to 1977), Touchet River near Touchet (1952 to 1955), Mill Creek near Walla Walla (1940 to 1977), Mill Creek at Walla Walla (1942 to 1977), Blue Creek near Walla Walla (1940 to 1971), and Dry Creek near Walla Walla (1949 to 1967). Values of the l0-, 50-, l00-, and 500-year peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data.

To define discharge-frequency data for all study areas, two methods of analysis were used. A regional relationship of basin characteristics to streamflow characteristics was the principal method used (Reference 7). The other method used was the regional relationship of peak discharge to drainage area for nearby gaging stations having similar hyrologic settings (Reference 7).

Discharges on Russell Creek decrease downstream of Depping Road for floods greater than a l0-year event due to a breakout on the Left (south) overbank at Depping Road. Flow is eventually returned to Russell Creek near. Wainwright Road and via Reser Creek.

Discharges on Mill Creek decrease downstream of Mill Creek Dam due to a diversion of flow into Mill Creek Diversion Channel and Yellowhawk and Garrison Creeks.

Peak discharge-drainage area relationships for streams studied by detailed methods are shown in Table 1.

## 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in the county were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Table 1. Summary of Discharge:

| Flooding Source and Location | Drainage Area (Square Miles) | Peak Discharges (Cubic Feet per Second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| **Walla Walla River** | | | | | |
| Downstream of Confluence With Touchet River | 1,657 | 15,800 | 26,800 | 32,600 | 49,300 |
| Upstream of Confluence With Touchet River | 902 | 10,540 | 19,000 | 24,200 | 39,000 |
| Downstream of Confluence With Dry Creek | 667 | 8,770 | 16,500 | 21,500 | 36,200 |
| Upstream of Confluence With Dry Creek | 427 | 6,700 | 13,500 | 18,000 | 32,600 |
| Upstream of Confluence With Lower Mill Creek | 297 | 5,300 | 11,000 | 14,600 | 27,300 |
| Upstream of Confluence With Yellowhawk Creek | 214 | 4,420 | 9,500 | 12,800 | 24,300 |
| **Touchet River** | | | | | |
| At Mouth | 733 | 7,900 | 13,100 | 15,800 | 23,500 |
| At Bolles | 372 | 6,000 | 9,900 | 12,000 | 18,000 |
| Upstream of Confluence With Coppei Creek | 321 | 5,400 | 8,900 | 10,860 | 16,000 |
| **Lower Mill Creek** | | | | | |
| At Mouth | 110.0 | 1,460 | 2,850 | 4,500 | 5,500 |
| At USGS Gage at Walla Walla | 95.7 | 1,460[1] | 2,850[1] | 4,500[1] | 5,500[1] |
| **Upper Mill Creek** | | | | | |
| Above Confluence With Blue Creek | 66.5 | 2,150 | 3,800 | 4,700 | 7,350 |
| Below Wickersham Bridge | 65.0 | 2,050 | 3,530 | 4,350 | 6,500 |
| At River Mile 20 | 62.8 | 2,000 | 3,300 | 3,970 | 5,850 |
| Below Kooskooskie | 61.9 | 1,960 | 3,260 | 3,900 | 5,800 |

[1] Decrease Due to Diversion Into Mill Creek Diversion Channel and Yellowhawk Creek From Upper Mill Creek

Table 1   Summary of Discharges (Cont'd)

| Flooding Source and Location | Drainage Area (Square Miles) | Peak Discharges (Cubic Feet per Second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Yellowhawk Creek | | | | | |
| At Mouth | 65.4 | 1,710 | 3,420 | 4,500 | 8,100 |
| Above Confluence With Cottonwood Creek | 32.7 | 950 | 1,900 | 2,500 | 4,500 |
| Cottonwood Creek | | | | | |
| At Mouth | 28.7 | 860 | 1,700 | 2,250 | 4,050 |
| Russell Creek | | | | | |
| At Mouth | 3[illegible] 7 | 91[illegible] | 1,800 | 2,400 | 4,300 |
| Above Confluence With Reser Creek | 18.7 | 730 | 1,460 | 1,920 | 3,500 |
| Downstream of Depping Road | --[1] | 730 | 1,234[2] | 1,271[2] | 1,340[2] |
| Upstream of Depping Road | --[1] | 730 | 1,460 | 1,920 | 3,500 |
| Russell Creek Overflow Area | | | | | |
| At Confluence With Russell Creek | --[3] | 0 | 600 | 900 | 2,200 |
| Reser Creek | | | | | |
| At Mouth | 11.3 | 570 | 1,150 | 1,510 | 2,750 |
| Coppei Creek | | | | | |
| At Waitsburg | 37 | 760 | 1,520 | 2,000 | 3,650 |
| Dry Creek | | | | | |
| At Mouth | 240 | 4,700 | 10,000 | 13,300 | 25,300 |
| Below Confluence With Mud Creek | 30.5 | 1,170 | 2,280 | 2,980 | 5,300 |
| Above Confluence With Mud Creek | 20.2 | 910 | 1,780 | 2,310 | 4,050 |

[1] Data Not Available
[2] Decrease Due to Overbank Losses Into Russell Creek Overflow Area
[3] Drainage Area Not Applicable For Overflow Areas

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the U.S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 8).

Cross seet ion data for the backwater analyses for all st reams were obtained by ground surveys. All bridqcs, dams, and culverts were measured to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Hydraulic roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. The range of roughness values for streams studied by detailed methods are shown in Table 2.

Starting water-surface elevations were calculated using the normal depth method.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Areas of shallow flooding were determined using the U.S. Army Corps of Engineers HEC-2 computer program (Reference 8) and engi-neer ing judgment.

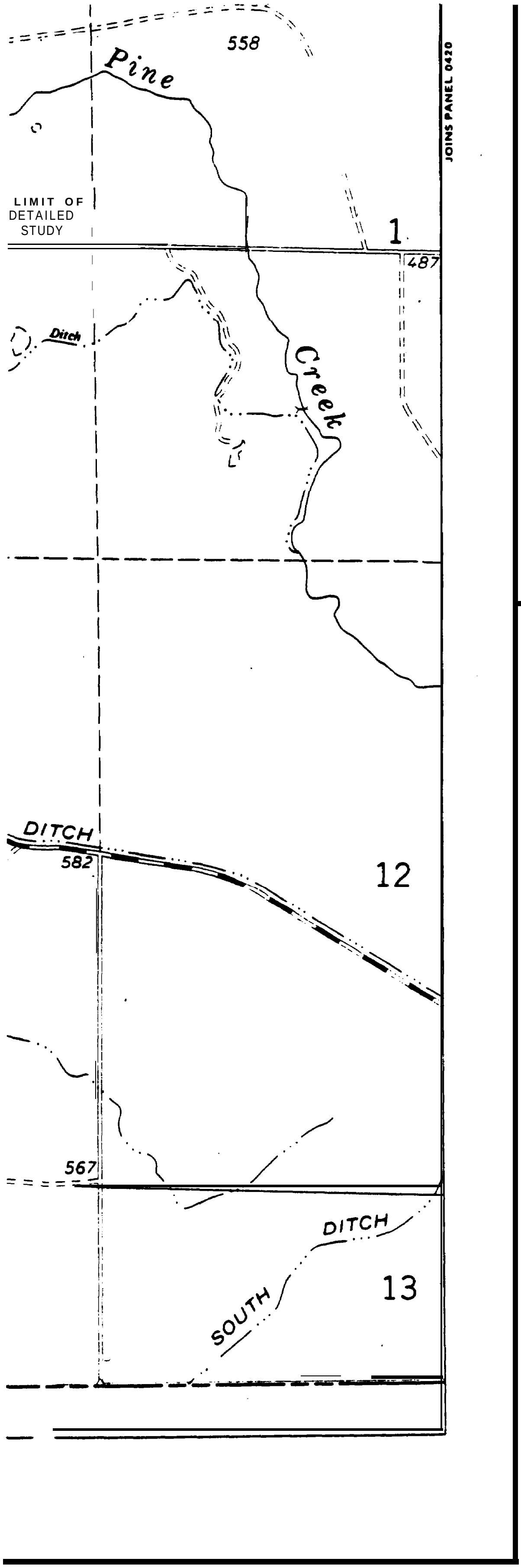
For streams studied by approximate methods, l00-year flood elevations were developed from normal depth calculations, aerial photographs (Reference 9), and ground observations.

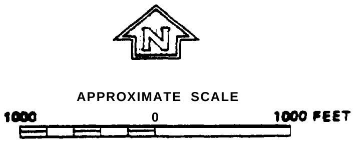
All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

A breakout on the left (south) overbank occurs on Ressell Creek at Deppinq Road for floods larger than a 10-year event.

Fl ow returns to Russell Creek vi a the area nor the of Reser Road (des ignated Russell Creek Over flow area) and vi a Reser Creek.

The ydraulic analyses for this study were based on unobst ructed f1ow. The f lood elevations shown on the profiles are thus consider ed valid only if hydraulic structures remain unobstructed, operte properly, and do not fail.




NATIONAL FLOOD INSURANCE PROGRAM

# FLOODWAY

## FLOOD BOUNDARY AND FLOODWAY MAP

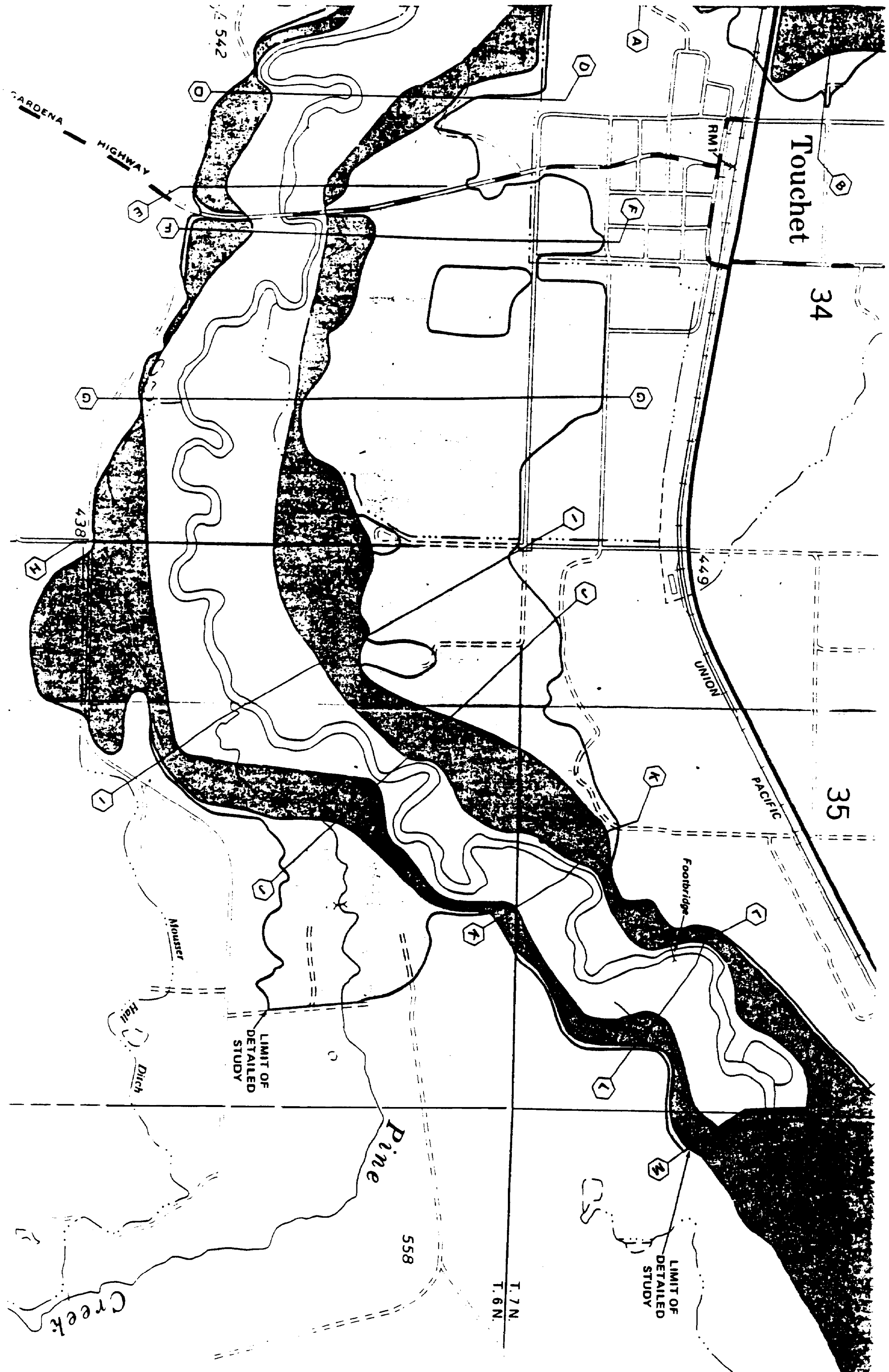
**WALLAWALLA** COUNTY,
WASHINGTON
(UNINCORPORATED AREAS)

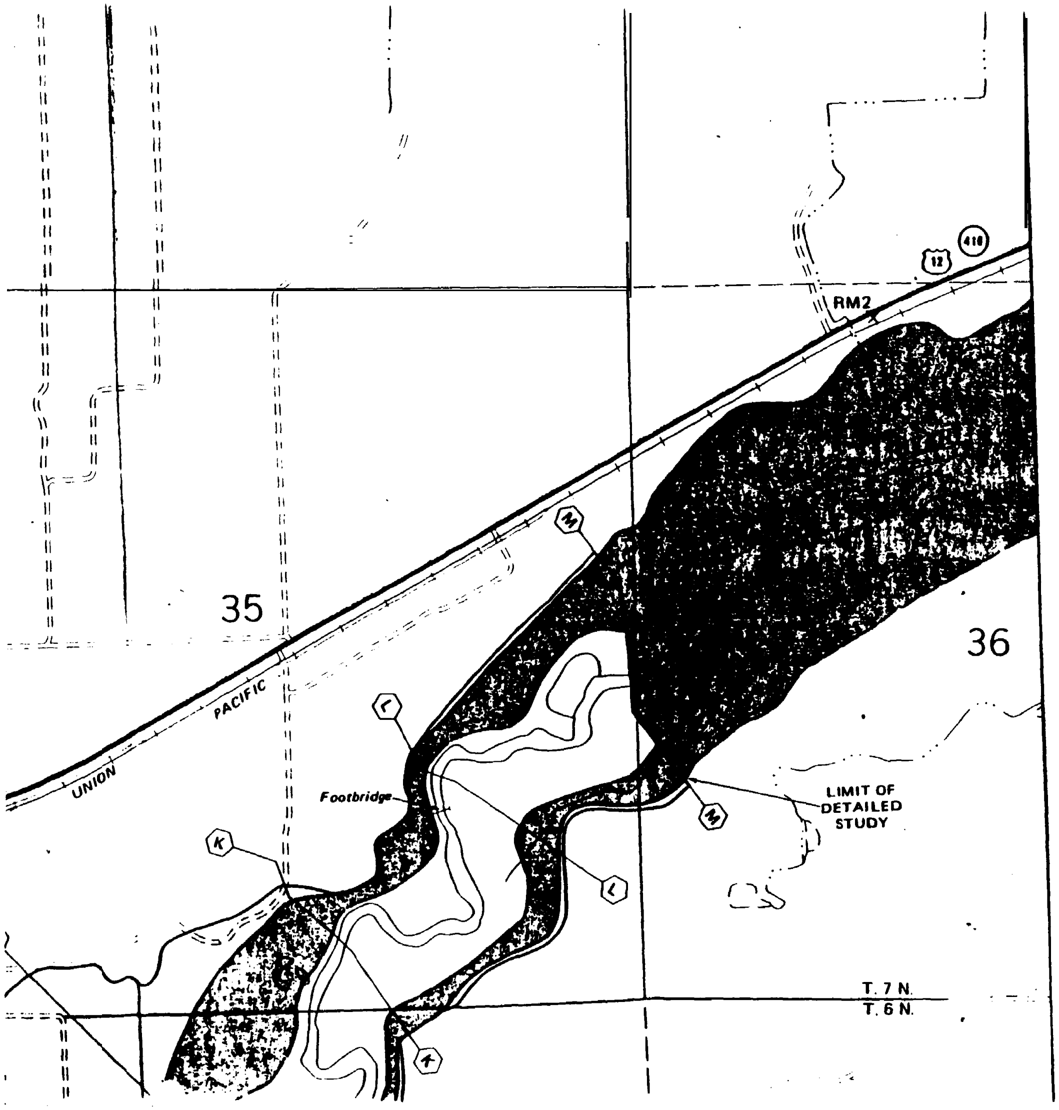
**PANEL 415 O F 500**
(SEE MAP INDEX FOR PANELS NOT PRINTED)

**COMMUNITY-PANEL NUMBER**
**530194 0415**

**EFFECTIVE** DATE:
**DECEMBER 1, 1983**

Federal Emergency Management Agency


Touchet
34
35
36
1
GARDENA HIGHWAY
RM1
UNION PACIFIC
Footbridge
LIMIT OF DETAILED STUDY
LIMIT OF DETAILED STUDY
Pine Creek
Mousser Hall Ditch
542
438
449
558
487
T.7N.
T.6N.
JOINS PANEL 0420




of the Federal Emergency Management Agency.

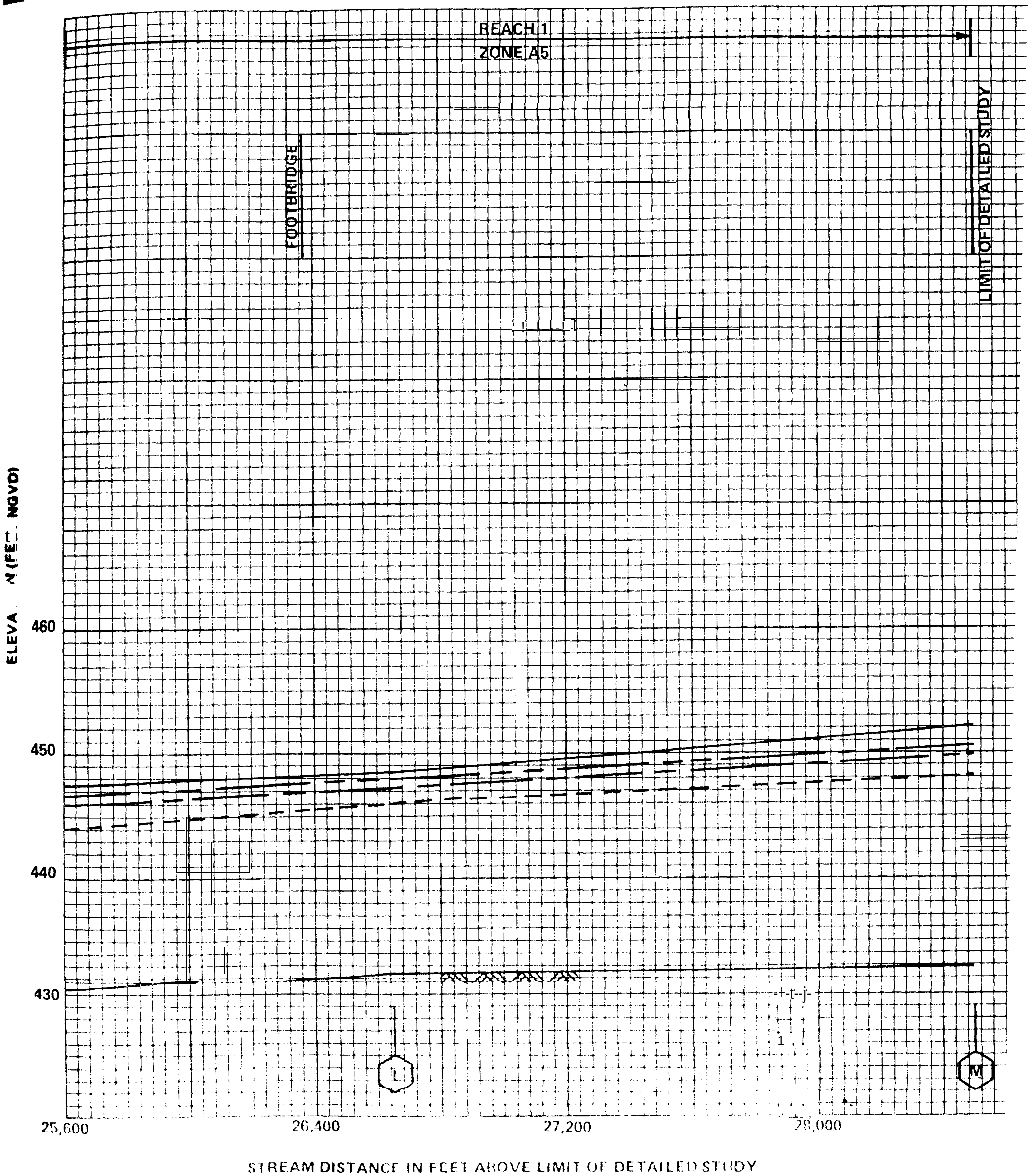
This map was prepared to facilitate flood plain management activities only; it may not show all special flood hazard areas in the community or all planimetric features outside of the flood plain. Refer to the latest official Flood Insurance Rate Map for any additional areas of special flood hazard.

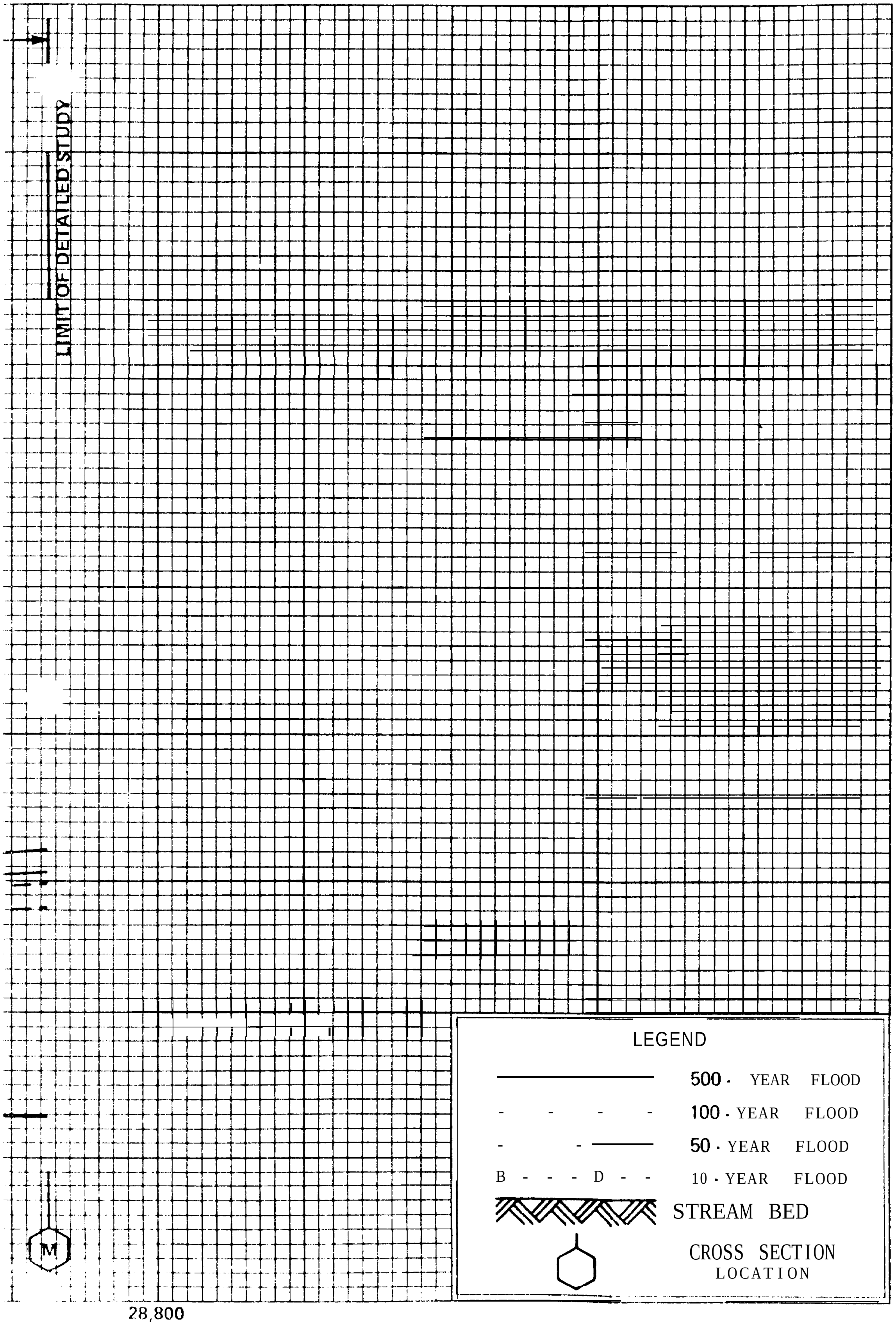
Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

For adjoining map panels, see separately printed Index to Map Panels.

Table 2. Manning's "n" Values

| Stream | Range of Roughness Values: Channel | Range of Roughness Values: Overbanks |
|---|---|---|
| Walla Walla River (At Touchet) | 0.040 | 0.035 |
| Walla Walla River (Near College Place) | 0.040 | 0.050 |
| Touchet River (At Touchet) | 0.035 to 0.040 | 0.040 |
| Touchet River (Near Waitsburg) | 0.040 | 0.035 to 0.045 |
| Lower Mill Creek | 0.035 to 0.045 | 0.040 to 0.050 |
| Upper Mill Creek | 0.030 to 0.070 | 0.030 to 0.100 |
| Yellowhawk Creek | 0.040 | 0.040 |
| Cottonwood Creek | 0.040 | 0.035 |
| Russell Creek | 0.040 | 0.040 to 0.050 |
| Russell Creek Overflow Area | 0.040 | 0.040 |
| Reser Creek | 0.022 to 0.035 | 0.035 |
| Coppei Creek | 0.040 | 0.035 to 0.040 |
| Dry Creek (At Dixie) | 0.040 to 0.060 | 0.020 to 0.100 |


REACH 1
ZONE A5
FOOTBRIDGE
LIMIT OF DETAILED STUDY
ELEVA
N (FE NGVD)
460
450
440
430
L
M
25,600
26,400
27,200
28,000
STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY



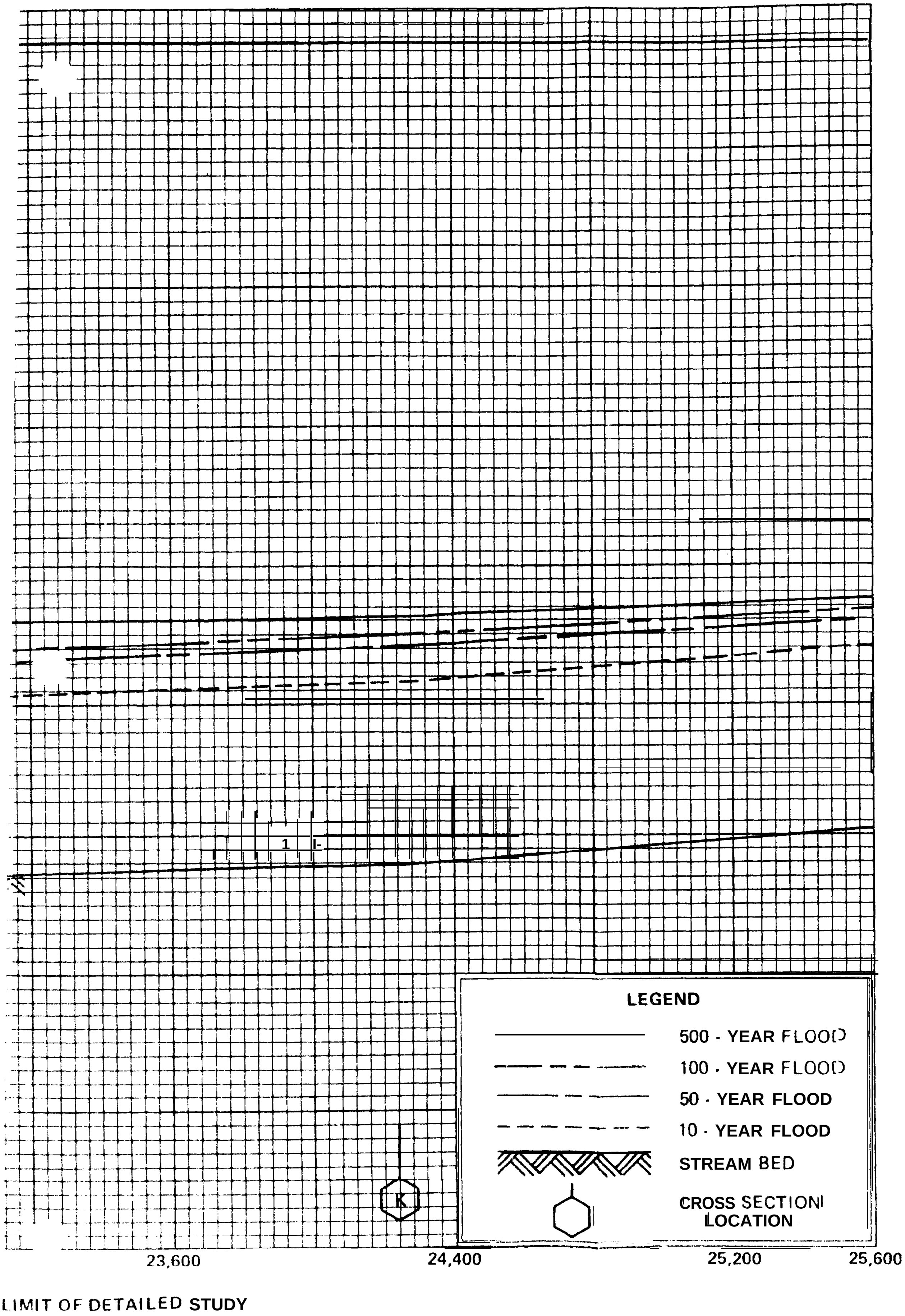

FLOOD PROFILES

WALLA WALLA RIVEF (AT TOUCHET)

FEDERAL EMERGENCY MANAGEENT AGENCY

WALLA WALLA COUNTY, WA
(UNINCORPORATED ARAS)

06P



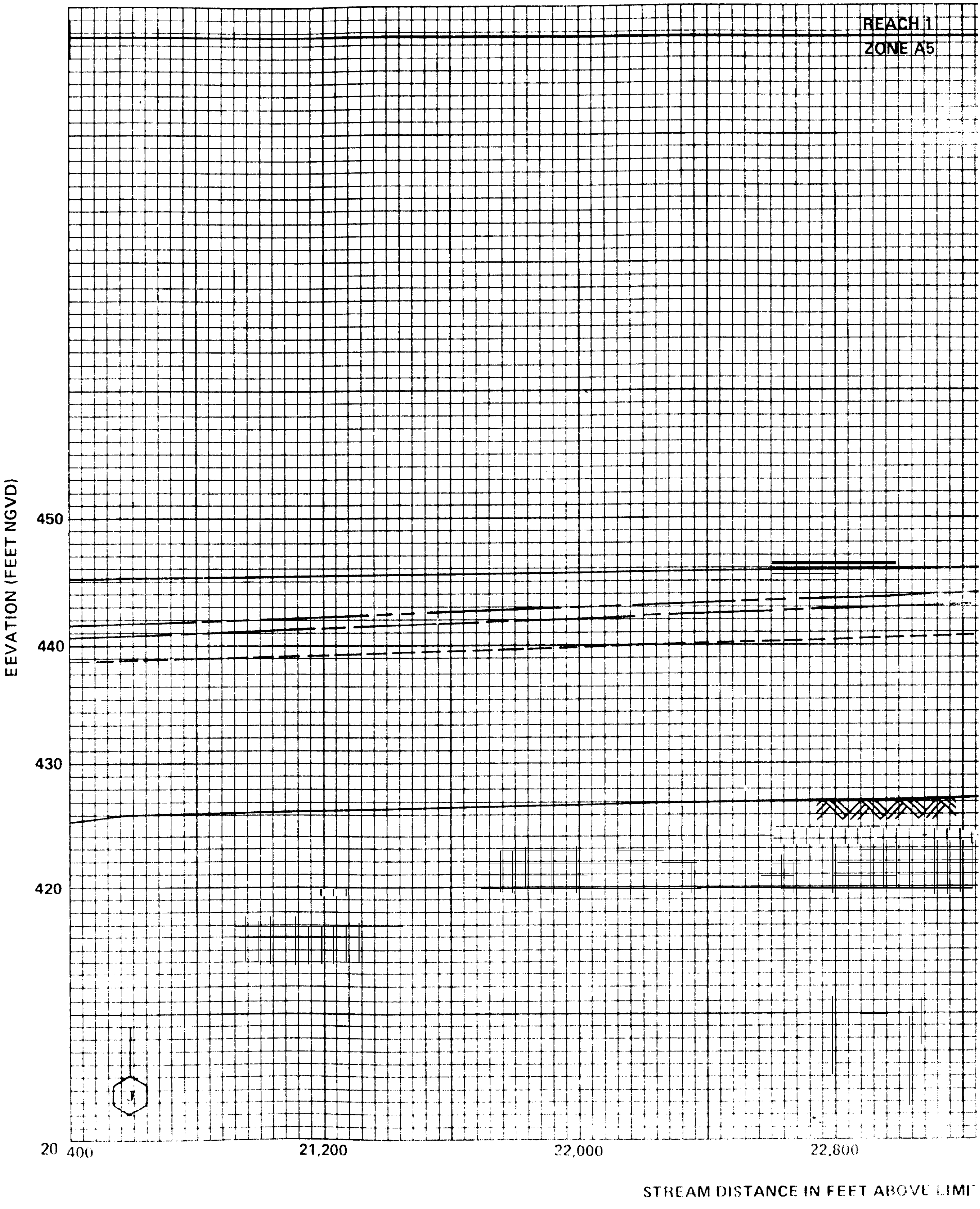

FLOOD PROFILES

WALLA WALLA RIVER (AT TOUCHET)

FEDERAL EMERGENCY MANAGEMENT AGENCY

WALLA WALLA COUNTY, WA
(UNINCORPORATED AREAS)

05P


REACH 1
ZONE A5
EEVATION (FEET NGVD)
450
440
430
420
20 400
21,200
22,000
22,800
STREAM DISTANCE IN FEET ABOVE LIMI

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NGVD) | | | |
| Walla Walla River (At Touchet) | | | | | | | | |
| A | 0 | 1,830 | 11,247 | 2.9 | 428.3 | 428.3 | 429.3 | 1.0 |
| B | 3,250 | 1,752 | S,LSƎ | 6.3 | 430.2 | 430.2 | 430.7 | 0.5 |
| C | 6,960 | 1,805 | 7,621 | 3.2 | 434.6 | 434.6 | 435.6 | 1.0 |
| D | 9,850 | 1,150 | 6,624 | 3.7 | 436.3 | 436.3 | 436.8 | 0.5 |
| E | 11,150 | 900 | 5,592 | 4.3 | 436.8 | 436.8 | 437.4 | 0.6 |
| F | 11,840 | 664 | 5,701 | 4.2 | 439.0 | 439.0 | 439.5 | 0.5 |
| G | 14,370 | 1,433 | 9,254 | 2.6 | 439.7 | 439.7 | 440.6 | 0.9 |
| H | 16,770 | 1,120 | 8,480 | 2.9 | 440.3 | 440.3 | 441.1 | 0.8 |
| I | 18,830 | 1,520 | 8,752 | 2.8 | 440.7 | 440.7 | 441.7 | 1.0 |
| J | 20,590 | 367 | 4,407 | S,S | 441.6 | 441.6 | 442.3 | 0.7 |
| K | 24,240 | 717 | 4,103 | S,9 | 444.9 | 444.9 | 445.7 | 0.8 |
| L | 26,650 | 795 | 4,476 | S,d | 448.0 | 448.0 | 449.0 | 1.0 |
| M | 28,500 | 900 | 5,141 | 4.7 | 450.6 | 450.6 | 451.3 | 0.7 |

[1]Feet Above Limit of Detailed Study

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

WALLA WALLA COUNTY, WA
(UNINCORPORATED AREAS)

**FLOODWAY DATA**

WALLA WALLA RIVER (AT TOUCHET)

541

# APPENDIX D

# GROUND WATER HYDROLOGY

REPORT OF GROUND WATER RESOURCE EVALUATION

WALLA WALLA AND WHITE BLUFFS ACCLIMATION FACILITIES

WALLA WALLA AND FRANKLIN COUNTIES, WASHINGTON

FOR THE

U.S. FISH AND WILDLIFE SERVICE



GeoEngineers Incorporated

GeoEngineers Incorporated

(206) 746-5200
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2405 - 140th Ave. N.E.
Bellevue, WA 98005

Consulting Geotechnical
Engineers and Geologists

June 4, 1987

Sverdrup Corporation
1200 - 112th Avenue Northeast
Bellevue, Washington 98009

Attention: Mr. Harold T. Andersen

Gentlemen:

We are submitting four copies of our report describing the results of our evaluation of the ground water resources at the proposed Walla Walla and White Bluffs acclimation facilities. The scope of our services is given in our technical services agreement with Sverdrup Corporation dated May 26, 1986.

We appreciate the opportunity to be of service and look forward to working with Sverdrup and the U.S. Fish and Wildlife Service in exploring and developing a ground water resource at the proposed acclimation facilities. Please call if you have any questions regarding our report.

Yours very truly,

GeoEngineers, Inc.

James A. Miller

James A. Miller
Principal

SEW:JAM:cs

File No. 0758-11-4

# TABLE OF CONTENTS



## List of Figures

# REPORT OF GROUND WATER RESOURCE EVALUATION
# WALLA WALLA AND WHITE BLUFFS ACCLIMINATION FACILITIES
# WALLA WALLA AND FRANKLIN COUNTIES, WASHINGTON
# FOR THE
# U.S. FISH AND WILDLIFE SERVICE

## INTRODUCTION

The results of the potential for developing ground water supplies at the proposed Walla Walla and White Bluffs acclimation facilities are presented in this report.

Our evaluation of the potential for development of ground water supplies at the proposed facilities is based on a review of available water well reports horehole geophysical logs and available publications.

## WALLA WALLA REGION

### GENERAL

The Walla Walla site is located on the Russel Bergevin Ranch in T7NR34E Sections 30 and 31. The location of the site is shown in Figure 1. The Walla Walla River transects the Bergevin Ranch. We understand that the proposed acclimation facility will take advantage of two surface water impoundments located near the river. One impoundment requires approximately 1 cfs (450 gpm) of ground water for development. The second impoundment will rely upon an existing drainage ditch as a water supply.

### REGIONAL HYDROGEOLOGY

The geology of the area is divided into three distinct hydrogeologic units--the upper sand and gravel, silt and clay known as Touchet Beds, and the Columbia River Basalt Group.

The upper sand and gravel unit is exposed along the banks of the Walla Walla River and extends to depths ranging from 80 to 115 feet. This aquifer heavily used in the Walla Walla region. The character of the aquifer is highly variable near the Bergevin Ranch and well capacities range from 75 gpm/ft to less than 1 gpm/ft (see Table 1).

Fine-grained silt and clay deposits of the Touchet Beds define the base of the upper sand and gravel unit. The clay unit acts as an aquitard and does not yield appreciable quantities of ground water to wells. The clay unit is as much as 130 feet thick.

The lower hydrogeologic unit consists of igneous rock from the Columbia River Basalt Group (CRBG). Basaltic lava belonging to the Saddle Mountains subgroup are found at depth near the Bergevin Ranch (Figure 2). Several aquifers capable of producing large quantities of ground water are contained within the basalt flows; however, the Walla Walla region is known for warm ground water temperatures within the basalt aquifers.

We understand that ground water temperatures above 20 degrees Celsius are not suitable for the rearing of fish. Using available information, we have plotted local bottom-hole temperatures versus bottom-hole depths on Figure 3. Based on this plot, we estimate that the 20 degrees Celsius isotherm occurs approximately 500 feet below ground surface in the Bergevin Ranch area.

## RECOMMENDATIONS

Based on our review of available data, it is our opinion that the Bergevin Ranch site shows a good potential for the development of a 1 cfs ground water supply. Well production and yields in this study area appear to be highly dependent upon the variability of the shallow aquifer and well construction techniques. We recommend the installation of a 10- to 12-inch-diameter test well to a maximum depth of 500 feet. In the event only small volumes of water are encountered in the upper sand and gravel unit, a field decision can be made to deepen the test well and explore the upper basalt flows. The aquifers encountered can be hydrologically and chemically tested during and after drilling. A pump test of the well will provide site-specific information necessary for design and construction of a well field.

# WHITE BLUFFS REGION

## GENERAL

The White Bluffs site is located in the northern portion of the Hanford Reservation along the east bank of the Columbia River (see Figure 4). The site appears to be generally level with sand and gravel exposed at the surface. A large irrigation ditch with an estimated flow of 20 cfs transects the site. The proposed acclimation facility will blend ground water with surface water from either the river or the irrigation ditch. We understand the amount of ground water used will depend entirely upon the resource available.

## REGIONAL HYDROGEOLOGY

Sedimentary deposits of the Ringold Formation are exposed along the valley slopes at the White Bluffs site. The Ringold Formation typically includes upper and lower fine-grained units of silt, silty sand and clay, with an intermediate unit of cemented gravel. The base of the Ringold consists of a thick sequence of silt and clay. Glacial floods and the Columbia River have incised the Ringold, thus exposing the uppermost silt and silty sand unit in White Bluffs. The coarser sand and gravel unit is also exposed along the base of White Bluffs; the gravel unit is believed to extend to a depth of approximately 150 feet beneath the site.

A sequence of coarse sand and gravel deposited along the valley floor by glacial floods and the Columbia River cap the sand and gravel unit of the Ringold. The thickness of this unit is unknown. These upper sand and gravel deposits are probably hydraulically connected to the Columbia River and have a good potential for sustaining several high yield wells.

Underlying the silt and clay base of the Ringold is the Saddle Mountains subgroup of the CRBG. Aquifers within the CRBG are capable of producing large quantities of water; however, high ground water temperatures may preclude the use of water from wells completed in the basalt.

Bottom-hole temperature for wells in the White Bluffs area are plotted versus bottom-hole depth in Figure 5. The temperature data suggest that the 20 degrees Celsius isotherm occurs approximately 300 feet below ground surface. This depth is likely to occur in the upper lava flows of the CRBG.

## RECOMMENDATIONS

Hydrologic information for the White Bluffs site is widely spaced and distant. The closest water well (T14NR26E-14) constructed in the Ringold sediments is located approximately five miles upstream. This well has a low yield (see Table 2); however, its specific capacity is high, indicating a potential for a shallow, large-volume ground water supply. Our interpretation of available information suggests that at least 1 cfs of ground water can be withdrawn from shallow depths at the White Bluffs site. We recommend drilling a 10- to 12-inch-diameter test well to an approximate depth of

200 feet. We anticipate that the hydrologic and chemical characteristics of both the flood gravels and coarse sediments of the Ringold can be tested by installation of the well.

## COST ESTIMATE

The following cost estimate should be considered as approximate because of the relatively uncertain nature of the hydrogeological conditions that will be encountered during test well construction. Costs may also vary with the time of well construction due to variable demand for drilling services and fluctuations in costs for well materials.

We estimate the cost of construction and pump testing of a 200-foot-deep test well at White Bluffs will range from $13,000 to $15,000. A 500-foot well In Walla Walla would cost approximately $29,000. We further estimate that *costs* for observing well construction, pump testing activities, analyzing the pump test data, and providing design parameters for production wells will range between $7,000 to $9,000. These estimated costs do not include provisions for difficult access conditions.

## SUMMARY AND CONCLUSIONS

The potential for developing a ground water supply at both sites appears favorable. We recommend that a test well be completed at each site prior to finalizing plans for the acclimation facility. We also recommend that a qualified geohydrologist from our staff be present during drilling to keep a detailed record of the boring, and to analyze pump test data while on site. We anticipate the test well on either site will be used as a production well to supply the acclimation facility.

Washington State law requires water rights to be secured for ground water withdrawals exceeding 5000 gallons per day (WAC 173-160-040). We have not investigated the current ground water appropriations for these areas and recommend that the water rights be secured before further exploration of the sites.

## USE OF THIS REPORT

We have prepared this report for use by Sverdrup Corporation and by the U.S. Fish and Wildlife Service. Our recommendations are based on a review of available hydrogeologic data and considerable judgment. Although the ground water supply potential appears promising at both sites, our interpretations should not be construed as a warranty of subsurface conditions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices In this area at the time the report was prepared. No other conditions, express or implied, should be understood.

0 0 0 -

We appreciate the opportunity to be of service. Please call if you have any questions regarding our report.

Respectfully submitted,

GeoEngineers, Inc.


Scott E Widness/by JAM

Scott E. Widness
Geological Engineer/Hydrologist

James A. Miller

James A. Miller
Principal

SEW:JAM:cs

TABLE 1 SUMMARY OF WATER WELL DATA - BERGEVIN RANCH, WALLA WALLA, WA

| WELL NUMBER (TN/RG-SEC) | DEPTH (FEET) | DEPTH TO STATIC WATER LEVEL (FEET) | YIELD (GPM) | SPECIFIC CAPACITY (GPM/FT. OF DRAWDOWN) | AQUIFER | TEMPERATURE (CELCIUS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| 6N/33E-1F | 979 | - | - | | BASALT | 31.8 | |
| 6N/33E-10H | 295 | - | - | | - | 16.4 | |
| 6N/34E-2B | 563 | 22 | - | | BASALT | | |
| 6N/34E-6B | 1508 | 135 | - | | BASALT | | |
| 6N/34E-7K | 1307 | - | - | | BASALT | 28.8 | |
| 6N/35E-18A | 1305 | 164 | - | - | BASALT | 28.7 | |
| 7N/33E-24Q | 1392 | 108 | - | | BASALT | 23.2 | |
| 7N/33E-31K | 863 | 105 | - | | BASALT | 27.7 | |
| 7N/34E-25N | 1102 | 22 | 442 | 6.5 | BASALT | 20.0 | |
| 7N/34E-27L | 87 | 6 | 315 | 8.3 | GRAVEL | | |
| 7N/34E-28A | 36 | 10 | 225 | 18.8 | GRAVEL | - | |
| 7N/34E-28B | 88 | 34 | 164 | 10.3 | GRAVEL | - | |
| 7N/34E-28C | 36 | 12 | 235 | 14.7 | GRAVEL | | |
| 7N/34E-28E | 127 | 34 | 250 | 4.5 | GRAVEL | | |
| 7N/34E-28K | 85 | 14 | - | | GRAVEL | 16.7 | CLAUS BERGEVIN WELL |
| 7N/34E-29C | 1201 | 75 | 1056 | 75.4 | BASALT | | |
| 7N/34E-29E | 20 | 6 | 200 | 14.3 | GRAVEL | | |
| 7N/34E-29F | 23 | 10 | 118 | 9.8 | GRAVEL | - | |
| 7N/34E-29H | 260 | 114 | 75 | 0.9 | BASALT | 14.4 | |
| 7N/34E-31C | 117 | 15 | 75 | 1.5 | GRAVEL | 8.9 | |
| 7N/34E-31D | 120 | 7 | 100 | 1.9 | GRAVEL | | |
| 7N/34E-31E | 16 | 9 | 20 | 5.0 | GRAVEL | 12.8 | |
| 7N/34E-31Q | 100 | 8 | 160 | 4.0 | GRAVEL | - | |
| 7N/34E-31R | 21 | 11 | 115 | 16.4 | GRAVEL | | |
| 7N/34E-32D | 16 | 8 | 30 | 6.0 | GRAVEL | | RUSSEL BERGEVIN WELL |
| 7N/34E-32L | 16 | 5 | 100 | 16.7 | GRAVEL | 7.2 | |
| 7N/34E-33E1 | 115 | 4 | 525 | 32.8 | GRAVEL | 12.2 | |
| 7N/34E-33E2 | 155 | 6 | 400 | 4.7 | GRAVEL | 16.7 | |
| 7N/34E-33G | 99 | 7 | 500 | 38.5 | GRAVEL | | |
| 7N/34E-33J | 68 | 2 | 200 | 15.4 | GRAVEL | | |
| 7N/34E-34E1 | 154 | 10 | 190 | 1.5 | GRAVEL | - | |
| 7N/34E-34E2 | 144 | 7 | 340 | 7.7 | GRAVEL | | |
| 7N/34E-34J | 147 | 6 | 130 | 1.1 | GRAVEL | | |
| 7N/34E-34N | 115 | 10 | 75 | 0.8 | GRAVEL | | |
| 7N/34E-35J | 155 | 6 | 400 | 4.8 | GRAVEL | | |
| 7N/34E-35R | 85 | 17 | 40 | 0.8 | GRAVEL | | |
| 7N/34E-36L | 107 | - | - | | GRAVEL | 13.4 | |
| 7N/35E-25A | 852 | - | - | | BASALT | - | |
| 7N/35E-25B | 230 | - | - | | - | 12.7 | |
| 7N/35E-33H | 697 | - | - | | BASALT | 24.0 | |
| 7N/35E-34L | 704 | 88 | - | | BASALT | 24.0 | |
| 7N/35E-35A | 1017 | - | - | - | BASALT | 20.5 | |
| 8N/33E-21Q1 | 620 | 530 | LOW | - | BASALT | 17.1 | |
| 8N/33E-21Q2 | 935 | - | LOW | | BASALT | 23.7 | |



GeoEngineers Incorporated

TABLE 2 SUMMARY OF WATER WELL DATA - WHITE BLUFFS, WA

| WELL NUMBER (TN/RG-SEC) | DEPTH (FEET) | DEPTH TO STATIC WATER LEVEL (FEET) | YIELD (GPM) | SPECIFIC CAPACITY (GPM/FT. /FT. OF DRAWDOWN) | AQUIFER | TEMPERATURE (CELCIUS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| 12N/26E-4N | 376 | - | - | - | - | 21.4 | |
| 12N/26E-7B | 404 | - | - | - | - | 20.7 | |
| 12N/26E-7Q | 317 | - | - | - | - | 20.4 | |
| 12N/26E-8P | 315 | - | - | - | - | 21.2 | |
| 12N/26E-12F | 507 | - | - | - | - | 21.0 | |
| 12N/26E-14D | 376 | - | - | - | - | 21.1 | |
| 12N/26E-15C | 430 | - | - | - | - | 21.7 | |
| 12N/26E-18E | 568 | - | - | - | - | 20.5 | |
| 12N/26E-18G | 273 | - | - | - | - | 20.8 | |
| 12N/26E-29G | 830 | 170 | 450 | 1.9 | BASALT | 24.4 | |
| 12N/27E-16K | 209 | - | - | - | - | 20.5 | |
| 12N/29E-28K | 684 | - | - | - | - | 20.0 | |
| 13N/25E-1N | 774 | - | - | - | - | 23.0 | |
| 13N/25E-6R | 60 | 43 | 58 | 8.7 | GRAVEL | - | |
| 13N/25E-7 | 93 | 61 | 250 | 125 | GRAVEL | - | |
| 13N/25E-11J | 103 | - | - | - | - | 39.1 | |
| 13N/25E-30G | 1110 | +190 | 1375 | 1375+ | BASALT | - | 82 PSI SHUT IN PRESSURE |
| 13N/26E-25 | 587 | - | - | - | - | 21.9 | |
| 13N/26E-26 | 250 | 110 | - | - | GRAVEL | - | |
| 13N/26E-35G | 5541 | - | - | | BASALT | 25.0 | |
| 13N/27E-16 | 84 | 51 | 265 | 133 | GRAVEL | - | |
| 13N/28E-13N | 1095 | - | - | - | - | 27.6 | |
| 14N/26E-14K | 77 | - | - | - | - | 32.5 | |
| 14N/25E-10 | 915 | - | - | - | - | 27.5 | |
| 14N/25E-17L | 65 | 15 | 10 | 0.5 | GRAVEL | - | |
| 14N/25E-21B | 510 | - | - | - | - | 22.0 | |
| 14N/26E-14 | 48 | 38 | 17 | 32 | GRAVEL | 15.6 | |
| 14N/26E-28E | 77 | - | - | - | - | 20.7 | |
| 14N/27E-24B | 1368 | - | - | - | - | 30.0 | |
| 14N/29E-9A1 | 844 | - | - | - | - | 22.3 | |
| 14N/29E-9A2 | 690 | - | - | - | - | 22.2 | |



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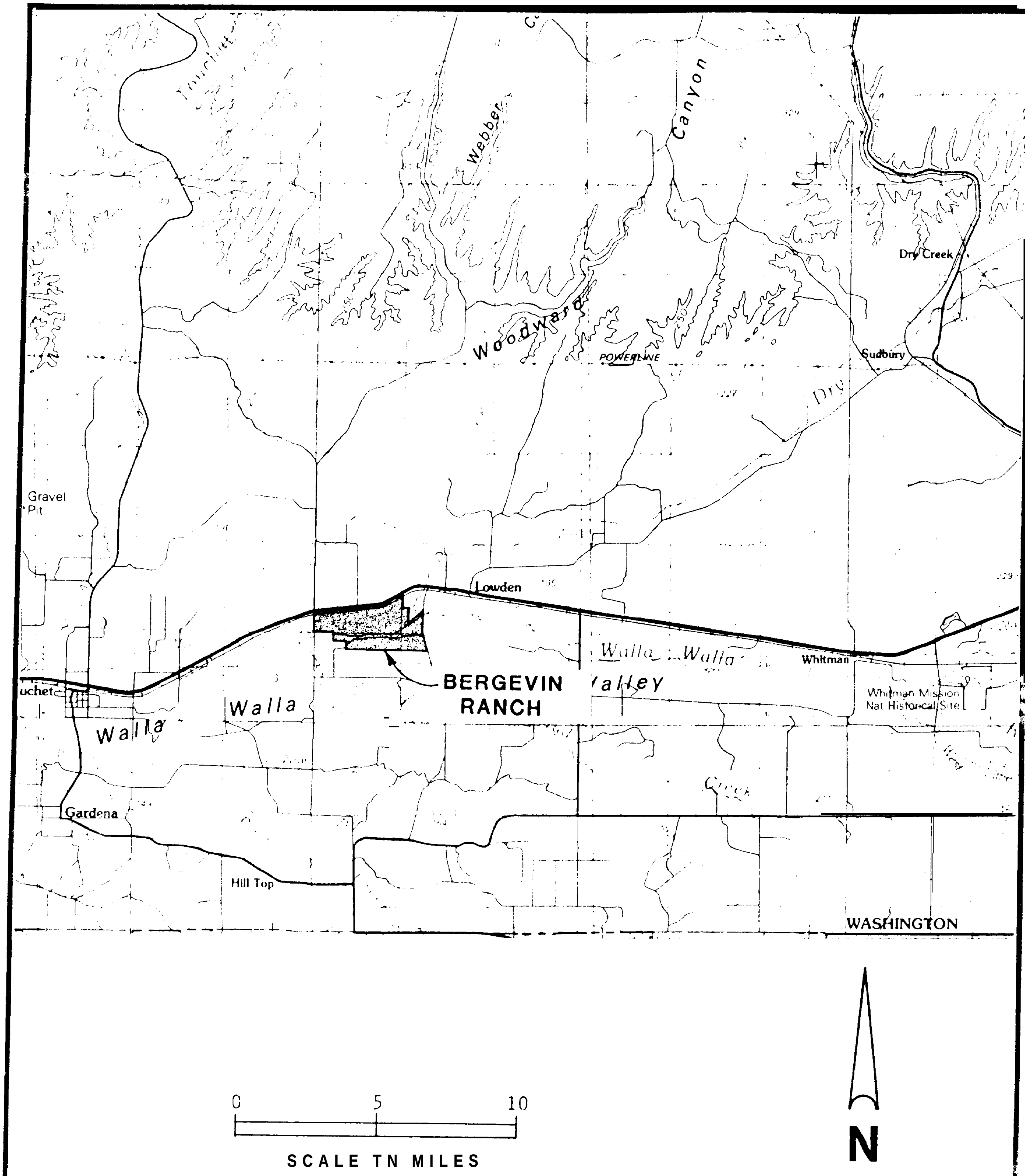


REFERENCE: USGS 'TOPOGRAPHIC QUADRANGLE MAP (SCALE 1:100,000). "WALLA WALLA, WASHINGTON/OREGON".

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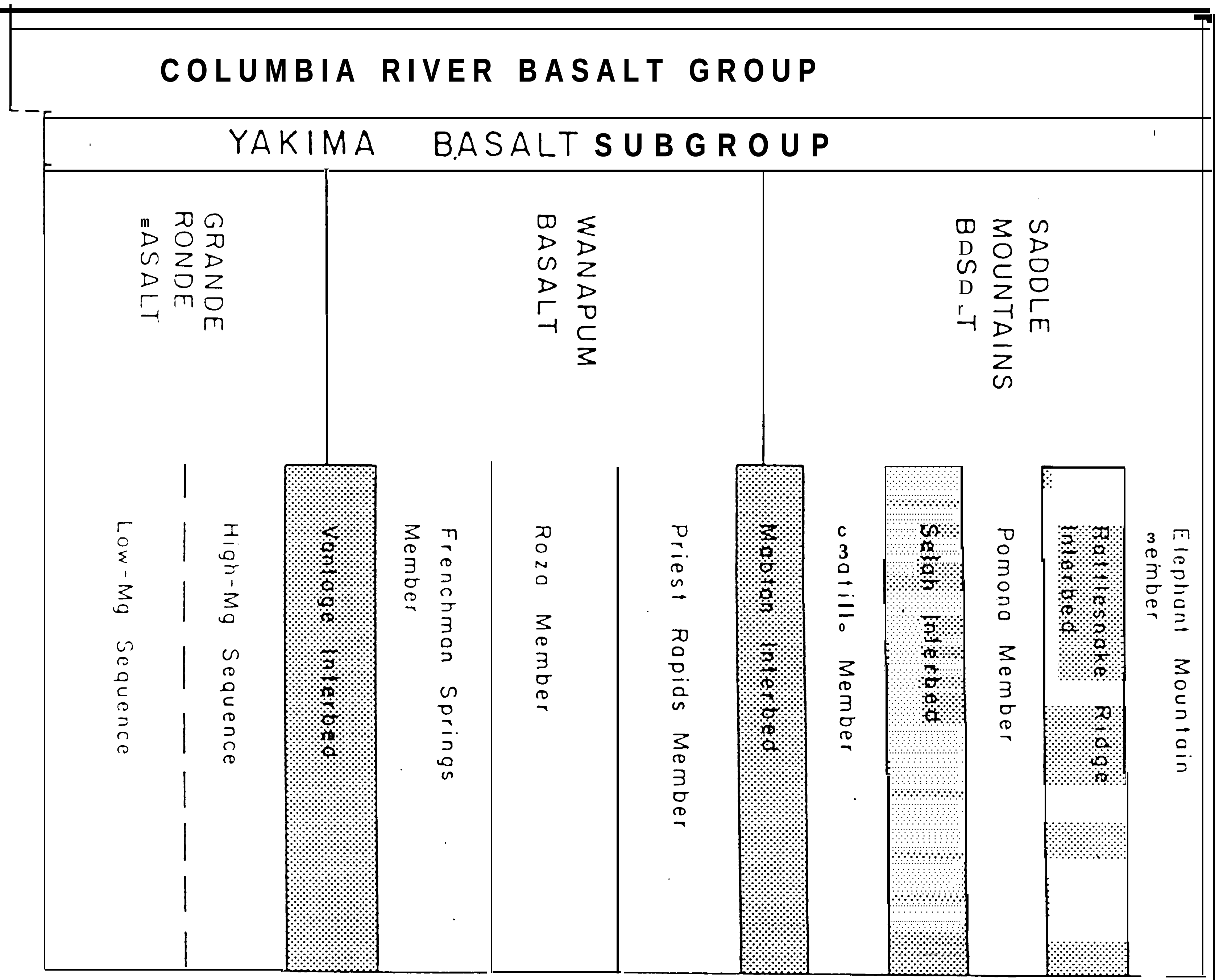
VICINITY MAP - WALLA WALLA

FIGURE 1

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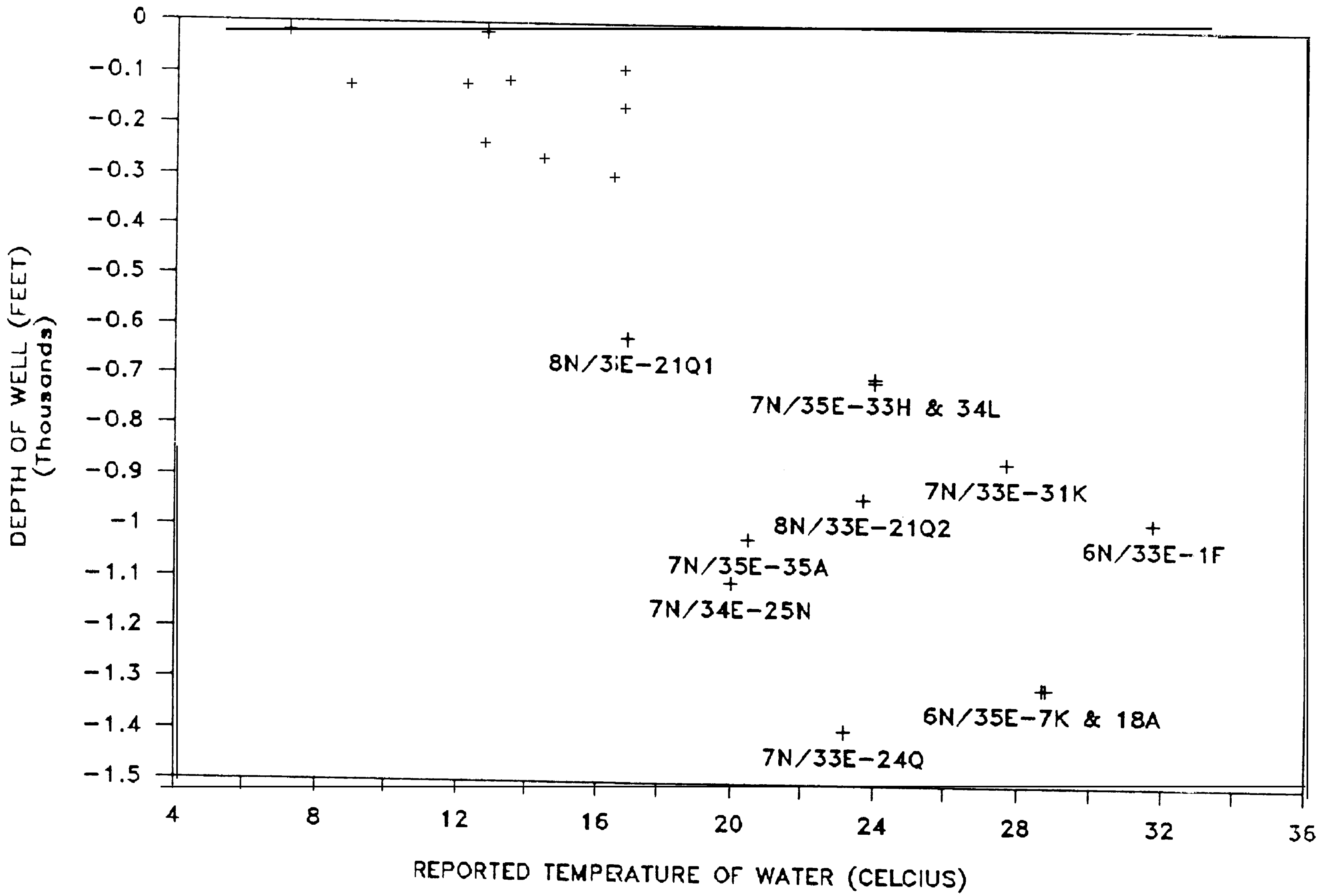
STRATIGRAPHIC RELATIONSHIP AND NOMENCLATURE

FIGURE 2

# BERGEVIN RANCH REGION

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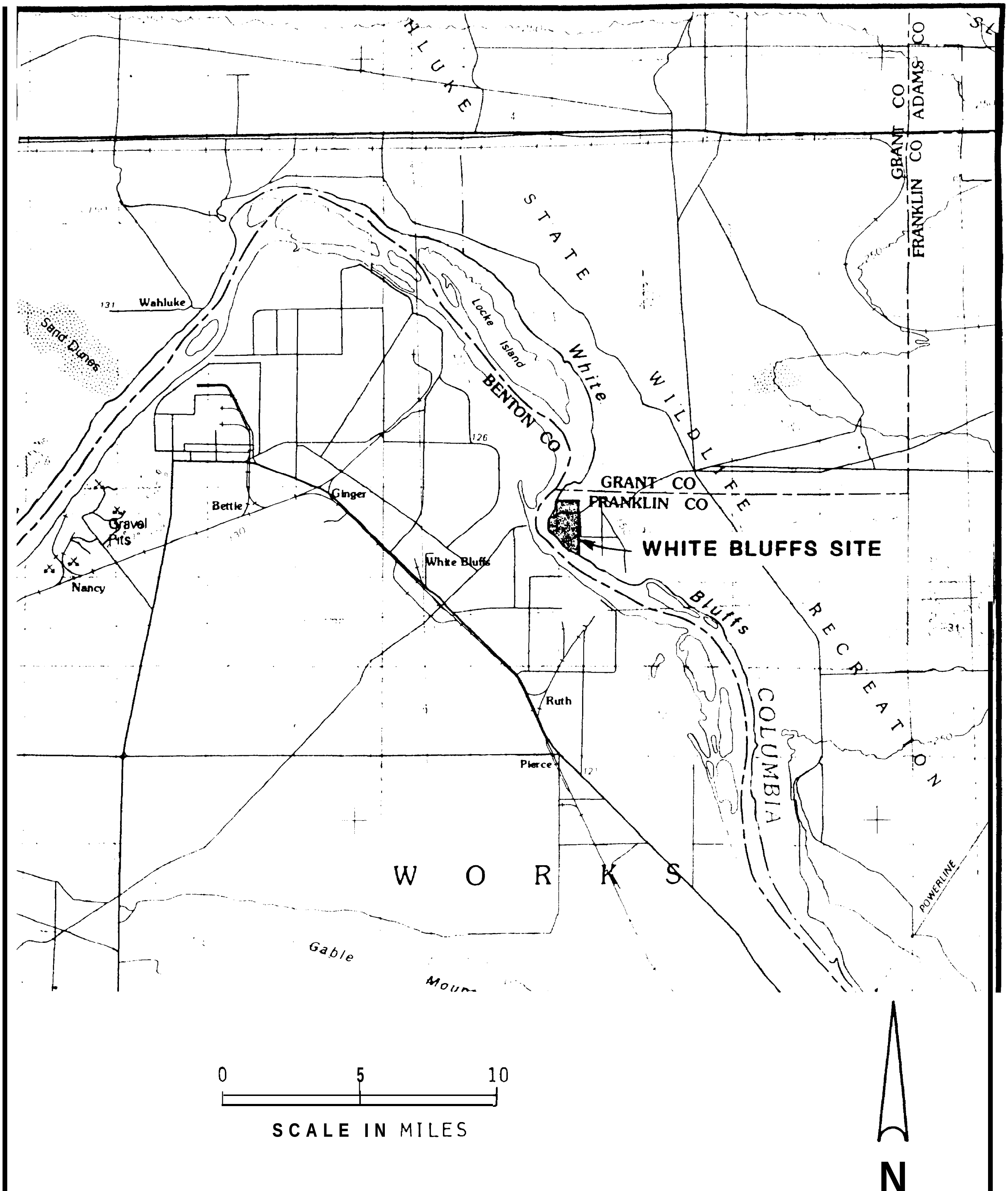
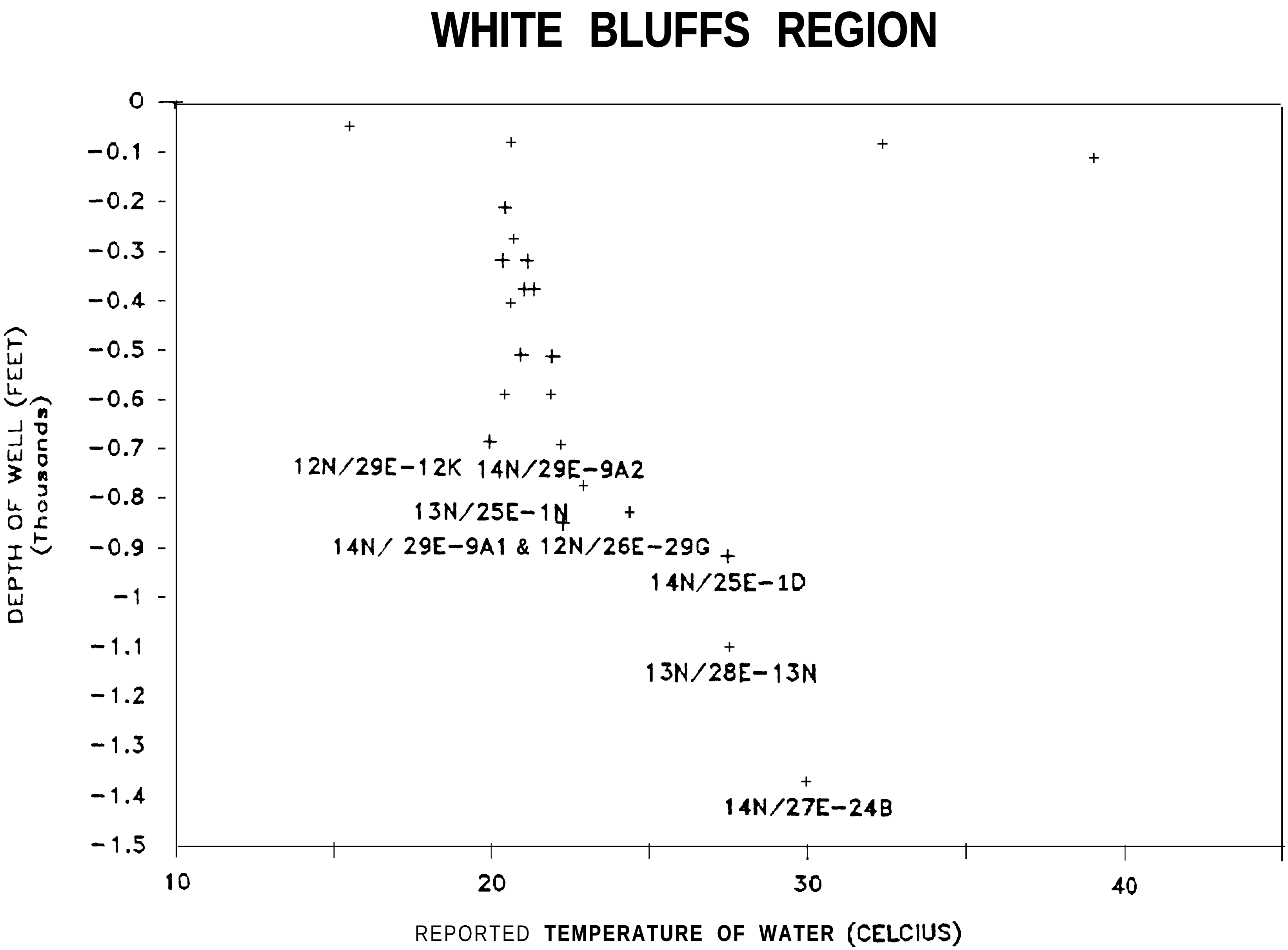
GROUND WATER TEMPERATURE
WALLA WALLA

FIGURE 3




REFERENCE: USGS TOPOGRAPHIC QUADRANGLE MAP (SCALE 1:100,000), "PRIEST RAPIDS, WASHINGTON."

| | |
|---|---|
| GeoEngineers Incorporated | VICINITY MAP - WHITE BLUFFS |
| | FIGURE 4 |

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GROUND WATER TEMPERATURE - WHITE BLUFFS

FIGURE 5

# APPENDIX E

## WATER QUALITY RESULTS

am test inc.

14603 N.E. 87th St, • REDMOND, WASHINGTON 98052 • 206/885-1664

ANALYSIS REPORT

CLIENT: Sverdrup Corporation

REPORT TO: Gary Wiggins
P.O. Box 369
Bellevue, WA 98009

DATE RECEIVED: 5/6/87 (704887)
5/5/87 (704874-876)

DATE REPORTED: 5/26/87

| Laboratory Sample Number | 704874 | 704875 | 704876 | 704877 |
|---|---|---|---|---|
| Client Identification | Ringold Spring | Ringold W W | Prosser | Walla Walla |
| Alkalinity (mg/l as $CaCO_3$) | 228. | 169. | 50. | 254. |
| Ammonia (mg/l) | 0.018 ] 0.017 | 0.059 | 0.054 | 0.077 |
| Chloride (mg/l) | 27. | 16. | <1.0 | 11. |
| Dissolved Oxygen (mg/l) | 15.1 | 9.9 | 12.8 | 11.4 |
| Nitrate & Nitrite (mg/l) | 4.30 | 2.41 | 0.440 | 0.97 |
| Nitrite (mg/l) | a.002 | 0.019 ] 0.019 | 0.011 | 0.011 |
| Total Suspended Solids (mg/l) | 3. | 32. | 107. | 12. |
| Settleable Solids (mg/l) | <0.1 | 0.1 | 0.7 | <0.1 |
| Copper (mg/l) | 0.003 | 0.002 | 0.003 | 0.002 |
| Zinc (mg/l) | 0.033 | 0.042 | 0.065 | 0.028 |

] - indicates duplicate analysis.

REPORTED BY John T. Dailey
John T. Dailey

JTD:vb

am test inc.
14603 N.E.87th • REDMOND, WASHINGTON 98053 • 206/885-1664

ANALYSIS REPORT

CLIENT: Sverdrup

DATE RECEIVED: 5/27/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue WA 98009

DATE REPORTED: 5/31/87

| Laboratory Sample Nos. | Client Identification | Total Kjeldahl Nitrogen (mg/l) | Total Dissolved Solids (mg/l) | pH |
|---|---|---|---|---|
| 704320 | 3 Mile Canyon | 0.272 | 145. | 8.0 |
| 704321 | Willow Creek | 0.300 | 168. | 8.1 |
| 704322 | Hat Rock | co.20<br>co.201 | 611. | 8.0<br>8.1] |
| 704874 | Ringold Spr. | co.20 | 506. | 8.0 |
| 704875 | Ringold WW | 0.438 | 371. | 8.5 |
| 704876 | Prosser | 0.388 | 220. | 7.4 |
| 704887 | Walla Walla | 0.355 | 398. | 8.0 |

REPORTED BY John Dailey'

JD/pb

560

am test inc.

14603 N.E. 87th St. • REDMOND, WASHINGTON 98052 • 206/885-1664

RECEIVED
JUL 10 1987
SVERDRUP CORP.
SEATTLE OFFICE

ANALYSIS REPORT

CLIENT: Sverdrup

DATE RECEIVED: 6/24/87

REPORT TO: Harold Anderson
P.O. Box 369
Bellevue, WA 98009

DATE REPORTED: 7/7/87

| Laboratory Sample Number | 707298 | 707299 | 707300 |
|---|---|---|---|
| Client Identification | Hat Rock Pond | Walla Walla River | Ringold Use Water |
| Alkalinity (mg/l as $CaCO_3$) | 221. | 180. | 261. |
| Ammonia-Nitrogen (mg/l) | 0.035 | 0.059 | 0.195 |
| Chloride (mg/l) | 17.5 | 14.9 | 34.4 |
| Dissolved Oxygen (mg/l) | 18.8 | 14.5 | 12.0 |
| Nitrate & Nitrite (mg/l) | 4.34 | 1.05 | 4.47 |
| Nitrite (mg/l) | 0.010 | 0.013 | <0.002 |
| Total Kjeldahl Nitrogen (mg/l) | <0.20 | 0.206 | <0.20<br><0.20 |
| Total Dissolved Solids (mg/l) | 440. | 380. | 630. |
| Settleable Solids (mg/l) | <0.1 | <0.1 | <0.1<br><0.1 |
| pH | 7.88 | 8.09 | 7.57 |
| Copper (mg/l) | 0.009 | 0.005 | 0.008 |
| Zinc (mg/l) | 0.044 | 0.029 | 0.025 |

REPORTED BY [signature]
John T. Dailey

JTD:vb